Gridiron Fight™

Operation Maintenance And Service Manual



TEHKAN

CONTENTS

CRT MANUAL

LIST OF ILLUSTRATION

CRT MANUAL

1. SPECIFICATION

- Power supply   115V AC
- Power consumption   100W
- Weight   209 1/2 lbs

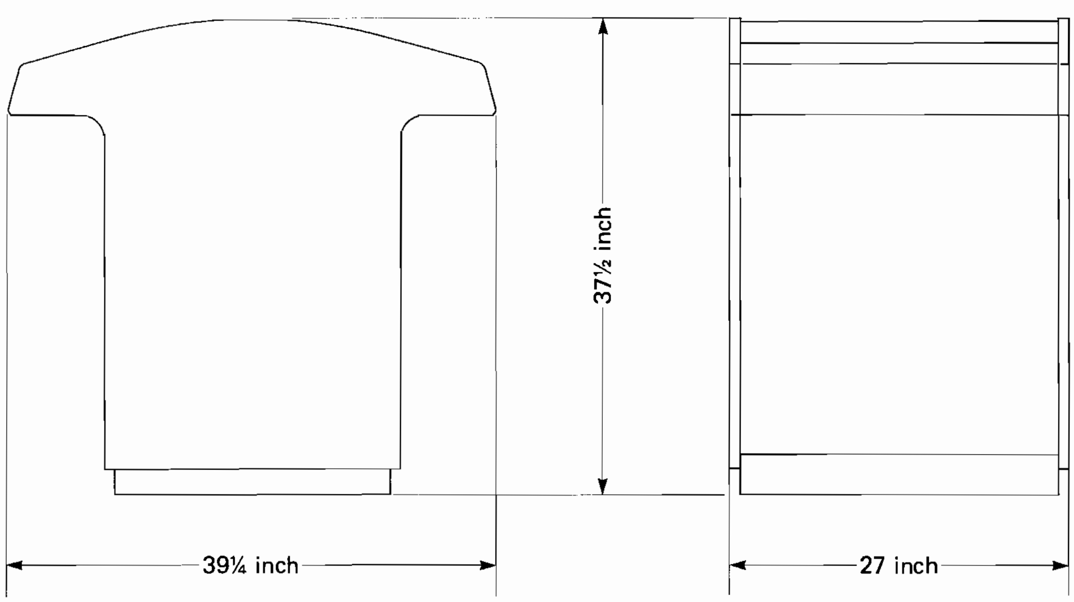


Fig. 1 External Dimensional Drawing

2. WARNING

⚠ WARNING ⚠

- ★ Use of non-TEHKAN parts or modification of any TEHKAN game circuitry may adversely affect the safety of your game, and may cause injury to you and your players.

- ★ This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instruction manual, may cause interference to radio communication. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J or Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

- ★ Players may receive an electrical shock if this game is not properly grounded! To avoid electrical shock, do not plug in the game until it has been inspected and properly grounded. This game should only be plugged into a grounded 3-wire outlet. If you have only a 2-wire outlet, we recommend you hire a licensed electrician to install a grounded outlet. Players may receive an electrical shock if the control panel is not properly grounded! After servicing any parts on the panel, check that the grounding clip is firmly secured to the metal tab on the inside of the control panel. Only then should you lock up the game.

- ★ Before connecting the game to the AC power source, verify that the proper voltage-selection plug is installed on the game's power supply.

- ★ To avoid electrical shock, disconnect the game from the AC power source before removing or repairing any part of the game. When removing or repairing the video display, extra precautions must be taken to avoid electrical shock because high voltages may exist within the display circuitry and cathode-ray tube, (CRT) even after power has been disconnected. Do not touch internal parts of the display with your hands or metal objects! Always discharge the high voltage from the CRT before servicing this area of the game. To discharge the CRT: attach one end of a large, well-insulated, 20-kV jumper to ground. Momentarily touch the free end of the grounded jumper to the anode by sliding it under the anode cap. Wait two minutes and discharge the anode again.

3. CAUTIONS

(1) **Care in Usage**

- Care should be taken to avoid dragging or dropping the machine when transporting to prevent damage to the CRT.
- Use fuse of indicated rating.
- As high voltage is present in the monitor and TV PCB, adjustments or repairs should be left up to a serviceman and should never be touched by the layman.

(2) **Care in Handling**

- Always turn off the power supply switch before handling.
- Avoid inserting and pulling the plug in rapid succession.
- Do not check the IC board circuit with a tester.
- Avoid rough handling in transportation; the picture tube is fragile.

(3) **Installation**

- As the video game is for "indoor use", do not install outdoors.
- When installing, avoid the following places.
  - a) Near indoor pools or showers
  - b) Where leaks exist
  - c) Under direct sunlight
  - d) Near heaters or other heat emitting devices
  - e) Near hazardous items (volatile fluids, gas cylinders, etc.)
  - f) Where vibrations are severe (near construction sites where jack hammers, etc. are used.)
  - g) Inclined places
  - h) Near fire extinguishing equipment
  - i) Near emergency exits

- Caution:
  - a) To prevent electric shock do not use this (polarized) plug with an extension cord, receptacle or other outlet unless the blades can be fully inserted to prevent blade exposure.

  In case the machine does not work properly after the power switch is turned on, make sure the proper voltage exists at the line cord.

(4) Trouble Shooting

When it is believed that trouble has developed, always confirm the following items.

- Is the fuse intact? (Always use fuse of the designated rating.) When the replaced fuse burns out again, this will indicate that another component is defective.
- Are there any poor connections (connectors) or open circuits? Special care must be taken to ensure connectors are firmly inserted. Troubles due to faulty contacts can be considered from various sources.
  Note: Always turn off the power when inserting or removing the connectors.
- There will be times when a normal picture will not appear when the power supply switch is turned on. As this may sometimes be corrected by a setting of the control circuit, turn power supply switch on and off several times.
- When testing meters, switches, etc. with a tester, always first pull the IC board connectors.

(5) Caution

"This equipment generates and uses radio frequency energy and if not installed and used properly, that is, in strict accordance with the manufacturer's instructions, may cause interference to radio and television reception. It has been type tested and found to comply with the limits for a Class A computing device in accordance with the specifications in Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient the receiving antenna
- Relocate the computer with respect to the receiver
- Move the computer away from the receiver
- Plug the computer into a different outlet so that computer and receiver are on different branch circuits.

If necessary, the user should consult the dealer or an experienced radio/television technician for additional suggestions. The user may find the following booklet prepared by the Federal Communications Commission helpful:

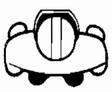
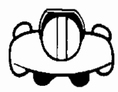
"How to Identify and Resolve Radio-TV Interference Problems". This booklet is available from the US Government Printing Office, Washington, D.C., 20402, Stock No. 004-000-00345-4.

4. HOW TO PLAY

(1) How to Play

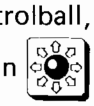
- **1 Player** — Player vs computer
- **2 Players** — Player vs opponent

- **Control your player with the Controlball!**

1st Player (Red-team)  2nd Player (Blue-team) 

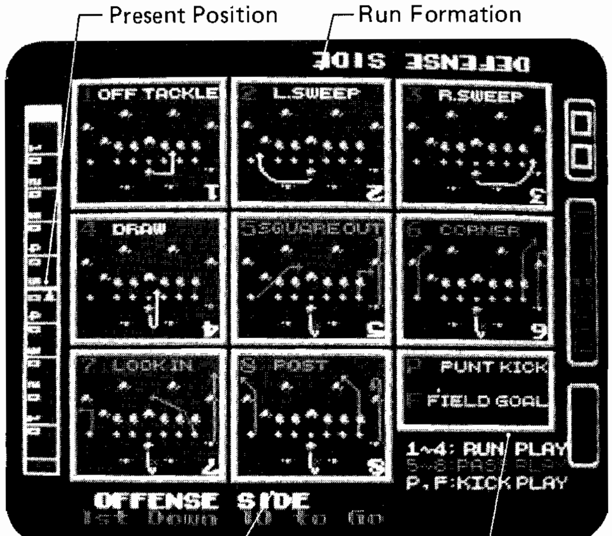
Pass : After selecting pass play, move QB to passing position, press Pass Button and rotate Controlball in the direction you want to pass.

Kick : In Kick Formation, rotate Controlball for kick and direction.

* Even when your player has disappeared beyond the screen, if you turn the Controlball, according to the direction indicated on  in the lower right part of the screen, you can return the disappeared player to the screen.

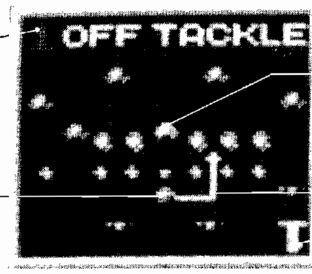
- **Choose the Formation during huddle**

With the Controlball, choose the desired Formation No., and press Formation Set Button.



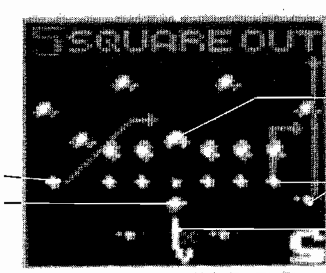
(2) Techniques

- **Run play (Formation No. 1 ~ 4)**



- For run offense
  Move QB in the direction indicated by selected Formation! (You can't pass.)
- For run defense
  Limit QB's advance by selecting Formation No. your opponent is likely to choose!

- **Pass play (Formation No. 5 ~ 8)**



- For pass offense
  After snap, move QB to desired position, locate the receiver you wish to pass to, press Pass Button and rotate Controlball in the direction of receiver.
- For pass defense
  Controlball controls MLB, you can blitz or drop back for pass interception.

- **Kick play (Formation No. P, F)**



- Kick
  Select punt or field goal according to offensive strategy.

5. HOW TO REMOVE MAIN PCB

(1) EMI Shield PCB & EMI Cage

- By loosening the screws (A) (four places) extract the EMI cage.
- By removing the screws (B) and (C) (four places each) extract the EMI shield PCB and the main PCB.

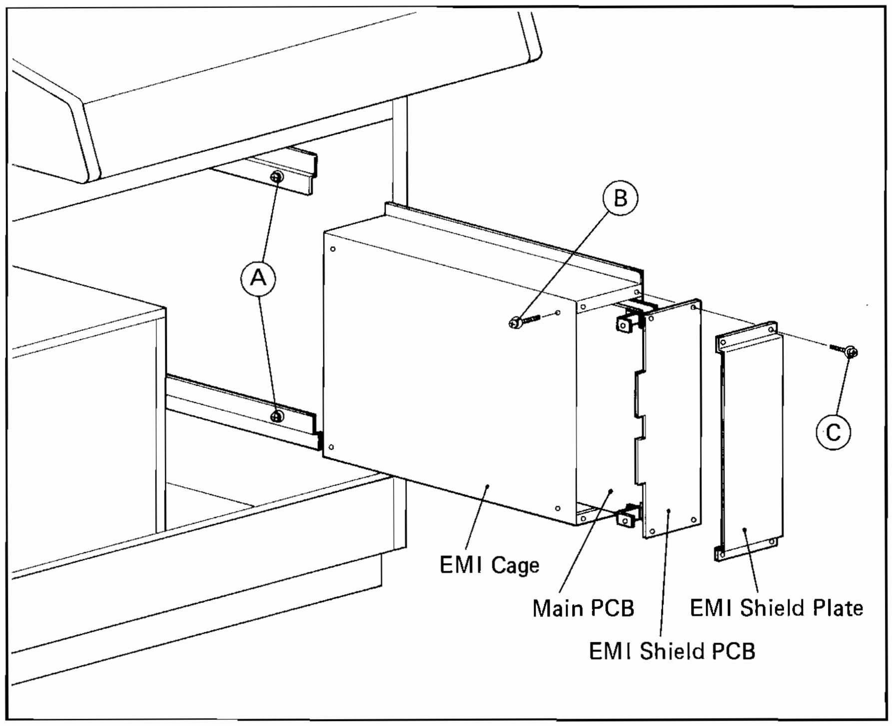
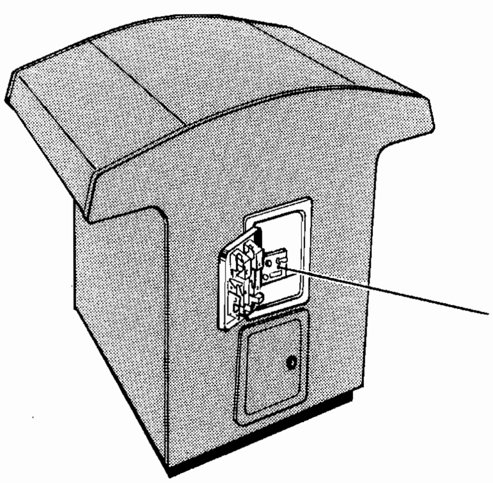


Fig. 2 EMI Shield PCB & EMI Cage

(2) Switch Panel Description



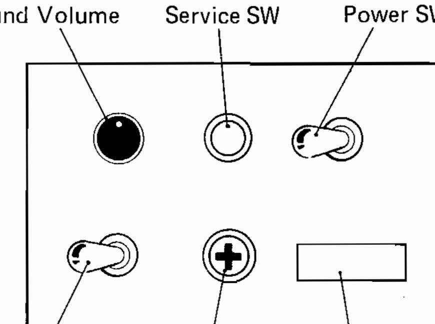


Fig. 3 Switch Panel

> **⚠ WARNING ⚠**
>
> **Use of non-TEHKAN parts or modifications of any TEHKAN game circuitry may have unfavorable effect upon the safety of your game, and may cause injury to you and your players.**

6. DIP SWITCH

- **Position of Dip SW**

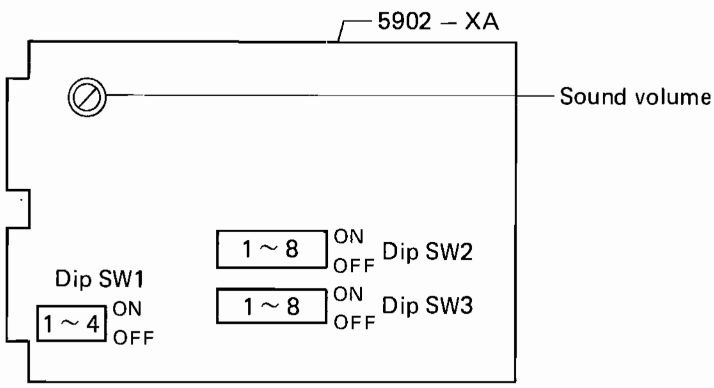


Fig. 4 Position of Dip SW

MAIN PCB

When removing PCB, refer to Fig. 2 on page 6.

- **Setting for Dip SW**

	1	2	3	4	5	6	7	8
Dip SW1	Unused							
Dip SW2	Coin/credit 1P	Coin/credit 2P	Defense huddle time		Count down		Huddle time	
Dip SW3	1P Game time		2P Game time			2P Extra time		Demon-stration sound

- **Dip SW2**
  - Coin/Credit

1P

1P \ SW	1
1 Coin 1 Play	OFF
2 Coin 1 Play	ON

2P (*Refer to extra time per coin.)

2P \ SW	2
2 Coin 1 Play	OFF
1 Coin 1 Play	ON

- Defense Huddle Time

Defense huddle time \ SW	3	4
Huddle time	OFF	OFF
5 Seconds after offense's formation setting	ON	OFF
3 Seconds 〃	OFF	ON
7 Seconds 〃	ON	ON

Huddle time for defense can be set after offense's formation setting.
Game starts with the formation number indicated at the time after this setting time has passed. (Refer to huddle time)

- Count Down

SW / Count down	5	6
1 Count 1 Second	OFF	OFF
〃 50/60 Second	ON	OFF
〃 54/60 Second	OFF	ON
〃 57/60 Second	ON	ON

Speed of the count down for game time can be set.

- Huddle Time

SW / Huddle time	7	8
15 Seconds	OFF	OFF
10 Seconds	ON	OFF
20 Seconds	OFF	ON
25 Seconds	ON	ON

Huddle time can be set.
Game starts with the formation number indicated at the time after this setting time has passed. (Refer to defense huddle time.)

- **Dip SW3**
  - 1P Game Time

SW / 1P Game time	1	2
1 : 30	OFF	OFF
1 : 00	ON	OFF
2 : 00	OFF	ON
2 : 30	ON	ON

- 2P Game Time (*Refer to extra time per coin.)

SW / 2P Game time	3	4	5
2 : 30	OFF	OFF	OFF
1 : 00	ON	OFF	OFF
1 : 30	OFF	ON	OFF
2 : 00	ON	ON	OFF
3 : 00	OFF	OFF	ON
3 : 30	ON	OFF	ON
4 : 00	OFF	ON	ON
5 : 00	ON	ON	ON

- 2P Extra Time (*Refer to extra time per coin.)

SW / 2P Extra time	6	7
1 : 00	OFF	OFF
0 : 00	ON	OFF
0 : 10	OFF	ON
0 : 30	ON	ON

Time is increased for 2P game when additional coin is inserted. Also extra time can be set in addition to the normal game time.
One half of time allocated will be added for each coin, when using 2 coins equal 1 play.

> 2 coins 1 play
> (2P game time) + (2P extra time) ÷ 2
>
> 1 coin 1 play
> (2P game time) + (2P extra time)

- Demonstration Sound

SW / Demonstration sound	8
Sound	OFF
No sound	ON

7. SELF TEST

(1) Self Check

When turning power ON, checks are conducted in the following sequence.

- ROM/RAM/Color Checks

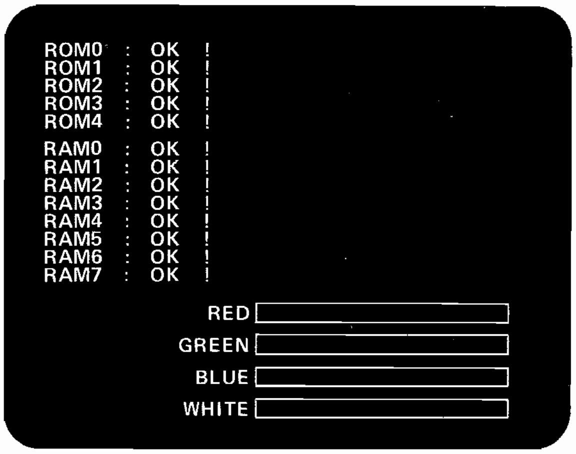


Fig. 5 Selt Check

When each of these checks is O.K., it is displayed for 4 seconds, then followed by the next display. If any of ROM and RAM is ERROR, repeat checking.

The color pattern is also displayed at the same time. At this time, when pressing **PASS & FORMATION SET** button, it continues to be displayed, so conduct color adjustment.

- Cross-hatch

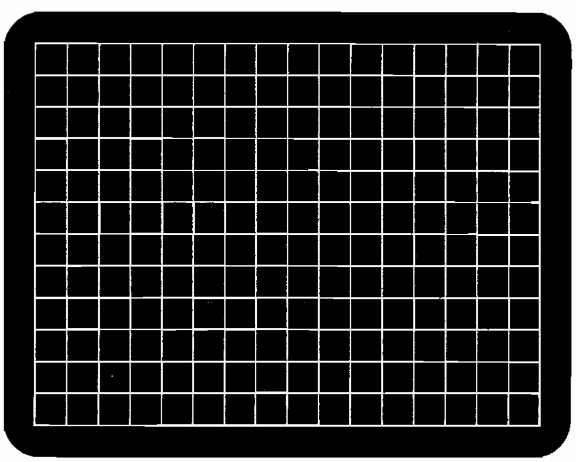


Fig. 6 Cross-hatch

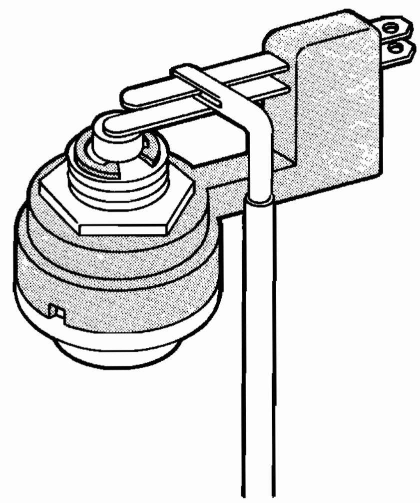
Then, cross-hatch is displayed for 4 seconds.

At this time, when pressing **PASS & FORMATION SET** button, it is displayed. When pressing again, a demonstration screen will follow.

8. MAINTENANCE

(1) Push Button Blade Switch

- Adjust the blade switch contacts for correct gaps.
- When the blade is bent, straighten it by using the blade adjusting rod.



⚠ WARNING ⚠

To prevent an electrical shock hazard, unplug the game prior to performing any maintenance.

Fig. 7 Blade Adjuster

- Take out carbon deposits on the blade switch by using a clean cloth, etc.

(2) Inspecting the Controlball

- Check the controlball to see if its roller shafts have worn.
  In case there is too large a clearance between the C.B spacer and the ball due to the excessive wear of the roller shaft, replace either the roller shaft A or the roller shaft B.
- Lubricate the control ball's ball bearings every month or 2,000 credits.
  After wiping out dust, etc. cleanly, place 2 or 3 drops of light duty oil on each of 6 ball bearings.

9. TROUBLE SHOOTING

(1) When the power switch has been turned ON after inserting the power plug into the outlet, no action ensues

- Check if the power source voltage is 115 V.
- Check if the plug has been normally inserted.
- Check if fuses have blown.

(2) When the power switch is in the ON state

- The controlball lamp and the coin slot lamp do not come on.
  a) Check if the filament is off.
  b) Check if voltage in the secondary side of the insulator-type transformer is normal at 12V AC.
  c) Check each connector if its contact is normal.

- No image appears on the CRT
  a) Check if the CRT heater is glowing.
  b) Check if power is supplied from the secondary side of the insulator-type transformer.
  c) Check if the CRT itself is malfunctioning.
  d) Check if the main PCB's 5V power source pilot lamp is lit, and 5V is being supplied from the DC power source.

- Images appear on the CRT, but the action seems to be incorrect.
  a) Check if the main PCB is supplied 4.5 ~ 5.5V of DC voltage.
  b) Check if there is improper contact between 3 CPUs (Z80A) on the main PCB 5902-XA and the IC 40-pin socket.
  c) Check if there is improper contact for the J5 connector (see Fig. 16).

- After turning power ON, ROM-RAM check is displayed on the video displays. In case any ROM or RAM fails, replace it as per the table below.

Device No.	Part number
RAM 0	5902-XA 5C
RAM 1	5902-XA 9D
RAM 2	5902-XA 9F
RAM 3	5902-XB 6P
RAM 4	5902-XB 6E
RAM 5	5902-XB 5A
RAM 6	5902-XA 7HJK
RAM 7	5902-XA 9R

Device No.	Part number
ROM 0	5902-XA 3A
ROM 1	5902-XA 3C
ROM 2	5902-XA 3D
ROM 3	5902-XA 9C
ROM 4	5902-XA 8R

- The cross-hatch on the video display is not normal.
  a) Adjust the knob for voltage supplied to the CRT, and the CRT's horizontal and vertical sync. knobs.

- The game is not credited even when a coin is inserted.
  a) Check if the coin is stopped up.
  b) Check if the coin mechanism or the coin micro-switch is malfunctioning.
  c) Check if the coin credit PCB is malfunctioning, or there is improper contact for each connector.

- The coin counter does not work.
  a) Check if the coin credit PCB is malfunctioning, or there is improper contact for each connector.
  b) Check if the coin counter itself is malfunctioning.

- 'Player Select' cannot be performed.
  a) Check if there is improper contact for the push button blade switch.
  b) Check if there is improper contact for the J3, J2 connectors (see Fig. 16).

- The controlball itself does not rotate smoothly.
  a) Check if there is something wrong with the ball bearings (see page 10, 'Maintenance').
  b) The controlball ceases to rotate smoothly when there occurs contact between the ball and C.B spacer, due to the loosening of 4 carriage bolts and nuts which fix the ball on the control panel.

- The control ball does not work.
  a) Adjust the interval between 2 photointerrupters of the photo PCB.
  b) Check if the disc plate is bent, or there is improper contact for each connector.

- LED PCB does not light up normally.
  a) Check if there is improper contact for each connector.
  b) Replace LED PCB, if the device turned out to be defective by replacing LED PCBs on right and left sides.

- Cannot perform 'Formation Set' or 'Pass'.
  a) Check if there is improper contact for the push button blade switch, or each connector.

10. ILLUSTRATED PARTS LIST

A. Cabinet

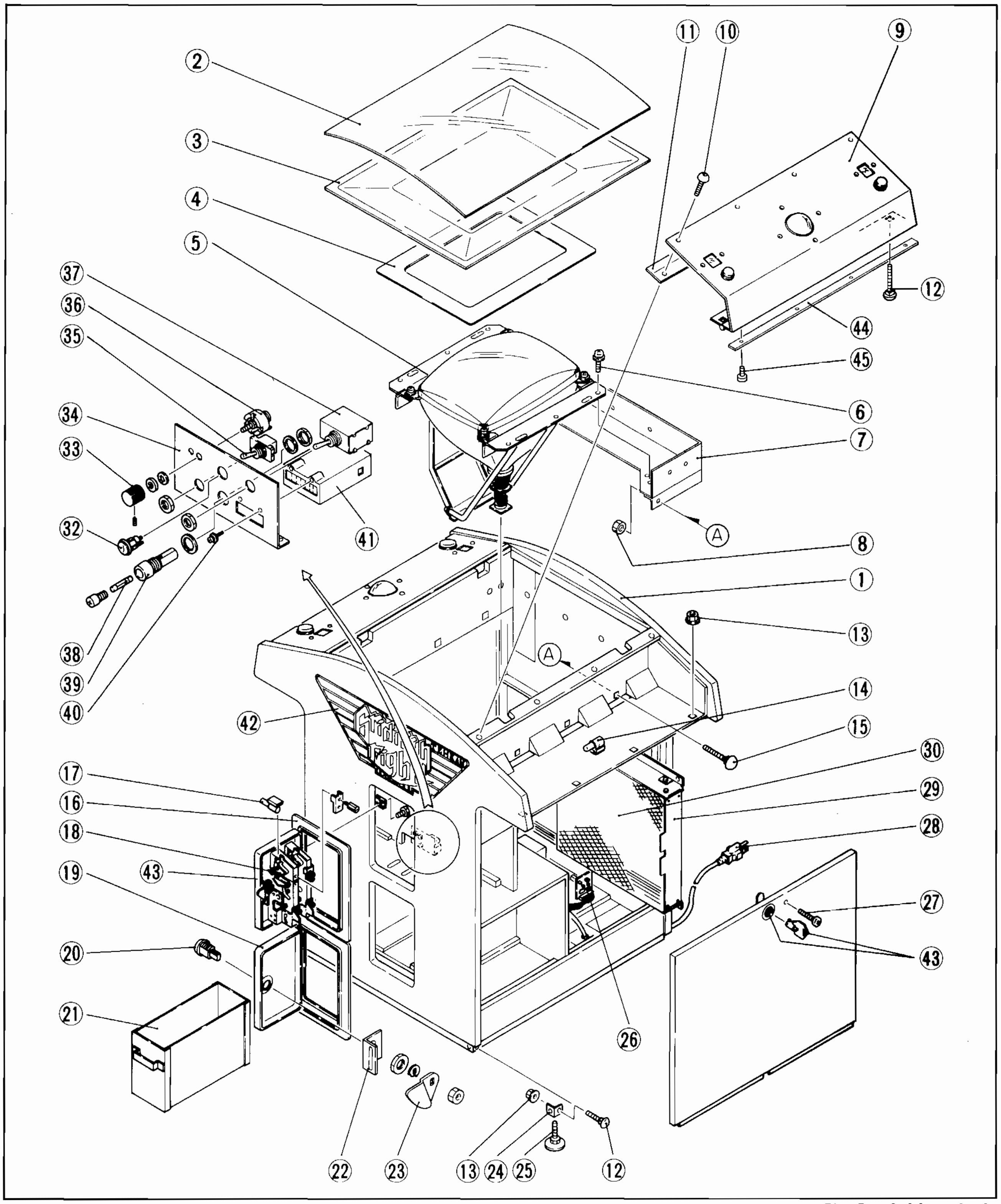


Fig. 8 Cabinet Ass'y

- **Cabinet Parts List**

Index No.	Part No.	Description	Q'ty
1	CA-01-001	Cabinet	1
2	PG-01-001	Cured Glass	1
3	RF-01-001	Smoke Shield	1
	PP-01-001	Instruction Seal	1 set
	PP-01-002	Graphic Seal	2
4	AP-02-001	CRT Masking Paper	1
5	E-02-001	CRT	1
6	MS-02-620	Machine Screw	4
7	BM-01-001	CRT Bracket	2
8	FN-02-005	Flange Nut	6
9	AM-01-001	Control Panel Ass'y (1 player)	1
	AM-01-002	" (2 player)	1
10	BB-02-630	Button Bolt	8
11	BM-01-002	Glass Plate	2
12	CB-02-630	Carriage Bolt	8
13	FN-02-006	Flange Nut	8
14	E-02-002	Lamp	2
	E-02-003	Lamp Socket	2
15	MS-02-530	Machine Screw	6
16	AM-02-001	Coin Door Ass'y	1
17	E-02-004	Lamp	2
	E-02-005	Lamp Socket	2
18	AM-02-002	Coin Mechanism (US 25c)	2
19	AM-02-003	Cash Door	1

Index No.	Part No.	Description	Q'ty
20	AM-02-004	Lock Ass'y	1 set
21	AM-01-003	Cash Box	1
22	AM-01-004	Lock Cam Bracket	2
23	AM-01-005	Lock Cam	2
24	BM-01-003	Adjuster Bracket	4
25	BM-01-004	Adjuster	4
26	E-02-006	Power Supply Ass'y	1
27	MS-02-420	Machine Screw	1
28	E-02-007	Power Cord	1
29	E-01-001	EMI Shield PCB	1
30	AM-01-006	EMI Cage	1
	E-01-002	Main PCB	1
31	E-02-008	Speaker	2
32	E-02-009	Service Switch	1
33	E-02-011	Volume Control Knob	1
34	BM-01-005	Switch Bracket	1
35	E-02-011	Demagnetizer Switch	1
36	E-02-012	Volume Control	1
37	E-02-013	Power Switch	1
38	E-02-014	Fuse	1
39	E-02-015	Fuse Post	1
40	MS-02-312	Machine Screw	2
41	E-02-016	Coin Counter	1
42	PP-01-003	Side Graphic (Both side)	1 set
43	AM-02-006	Lock Ass'y	1 set
44	BM-01-0	Overlay Stopper	1
45	MS-02-410	Machine Screw	4

⚠ WARNING ⚠

Use of non-TEHKAN parts or modifications of any TEHKAN game circuitry may have unfavorable effect upon the safety of your game, and may cause injury to you and your players.

To prevent an electrical shock hazard, be sure to turn the game off before removing or replacing components.

B. Control Panel Ass'y & Parts List

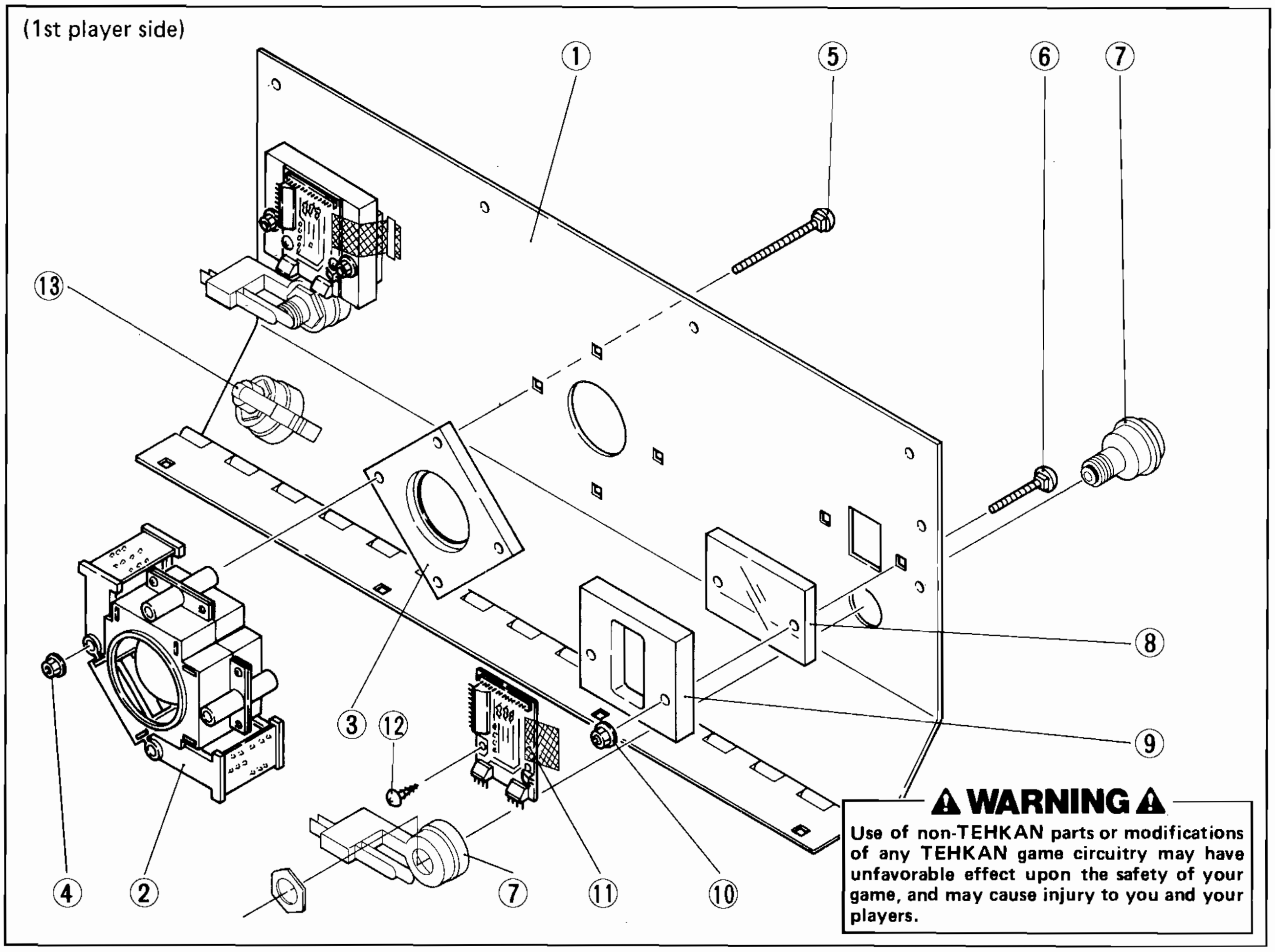


Fig. 9 Control Panel Ass'y

Index No.	Part No.	Description	Q'ty
1	BM-01-005	Control Panel (1st player)	1
	BM-01-006	" (2nd player)	1
	PR-01-001	Control Panel Overlay	2
	PM-01-001	Player Panel	1
2	AR-01-001	Control Ball Ass'y (Red)	1
	AR-01-002	" (Blue)	1
3	RF-01-002	C.B. Spacer	2
4	FN-02-006	Flange Nut	8
5	CB-02-675	Carriage Bolt	8

Index No.	Part No.	Description	Q'ty
6	CB-02-435	Carriage Bolt	8
7	RF-02-001	Push Button	4
8	RP-01-001	Purple Board	4
9	BW-01-002	LED PCB Bracket	4
10	FN-02-004	Flange Nut	8
11	E-01-003	LED PCB	4
12	WS-02-310	Wood Screw	8
13	RF-02-002	Push Button	2

C. Control Ball Ass'y & Parts List

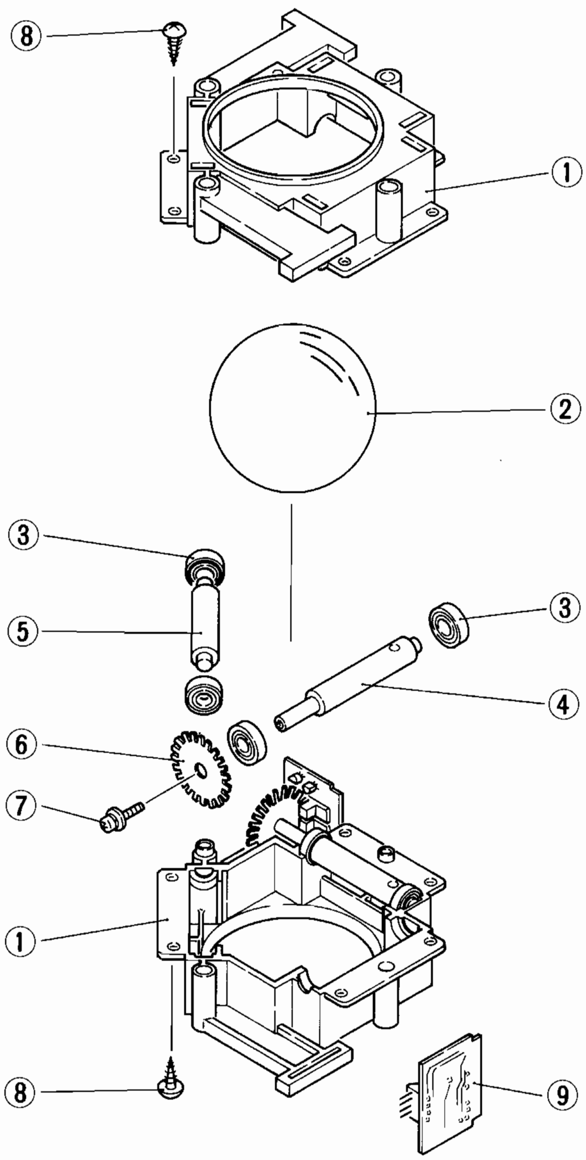


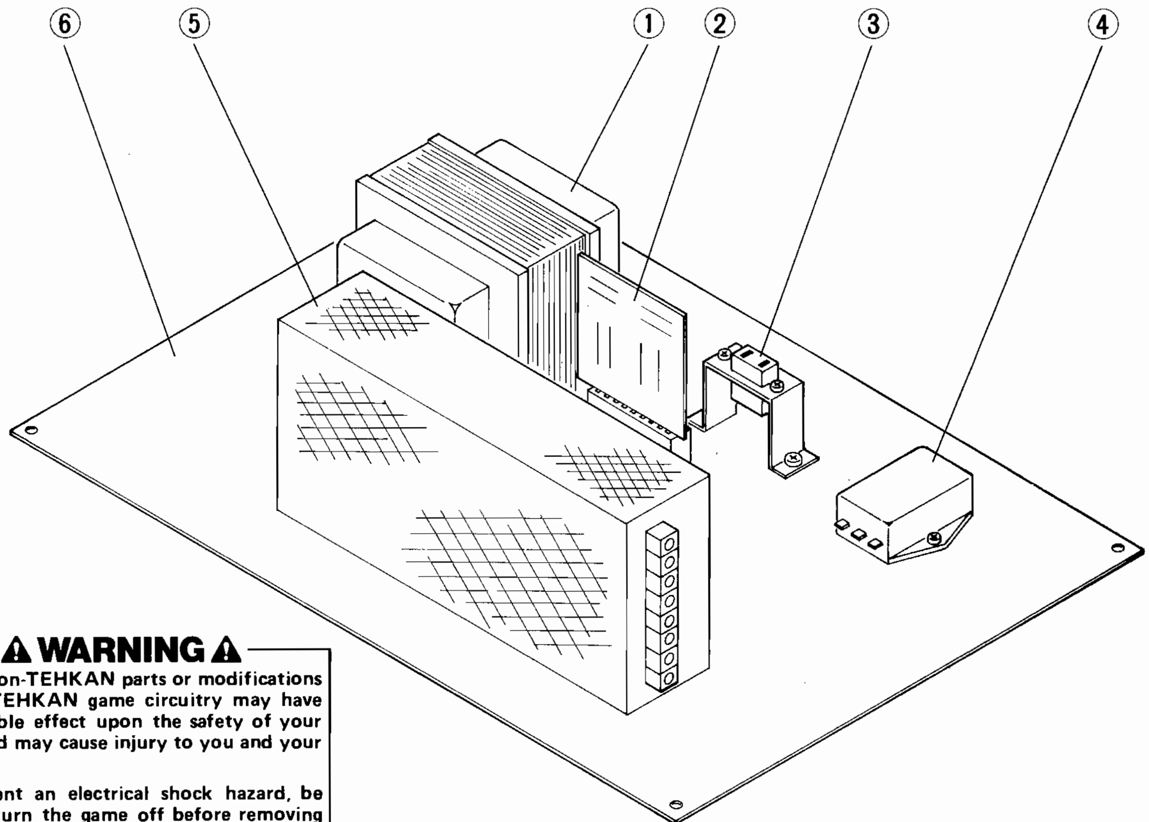
Fig. 10 Control Ball Ass'y

Index No.	Part No.	Description	Q'ty
1	RF-01-003	Housing	4
2	RF-02-003	Ball (Red)	1
	RF-02-004	" (Blue)	1
3	AM-02-005	Ball Bearing	12
4	AM-01-007	Roller Shaft A	4
5	AM-01-008	Roller Shaft B	2
6	BM-01-007	Disc Plate	4
7	MS-02-408	Machine Screw	4
8	MS-02-512	Machine Screw	12
9	E-01-004	Photo PCB	4

⚠ WARNING ⚠

Use of non-TEHKAN parts or modifications of any TEHKAN game circuitry may have unfavorable effect upon the safety of your game, and may cause injury to you and your players.

D. Power Supply & Parts List



⚠ WARNING ⚠

Use of non-TEHKAN parts or modifications of any TEHKAN game circuitry may have unfavorable effect upon the safety of your game, and may cause injury to you and your players.

To prevent an electrical shock hazard, be sure to turn the game off before removing or replacing components.

Fig. 11 Power Supply

Index No.	Part No.	Description	Q'ty
1	E-02-017	Transformer	1
2	E-01-005	Credit PCB	1
	E-02-018	Credit PCB Connector	1
	BM-01-008	Credit PCB Bracket	2
3	E-02-019	CRT Connector	1
	BM-01-009	CRT Connector Bracket	1

Index No.	Part No.	Description	Q'ty
4	E-02-020	Noise Filter	1
5	E-02-021	D.C. Power Supply	1
6	BM-01-010	Power Supply Plate	1

11. SCHEMATIC DIAGRAM

A. Power Board Schematic Diagram

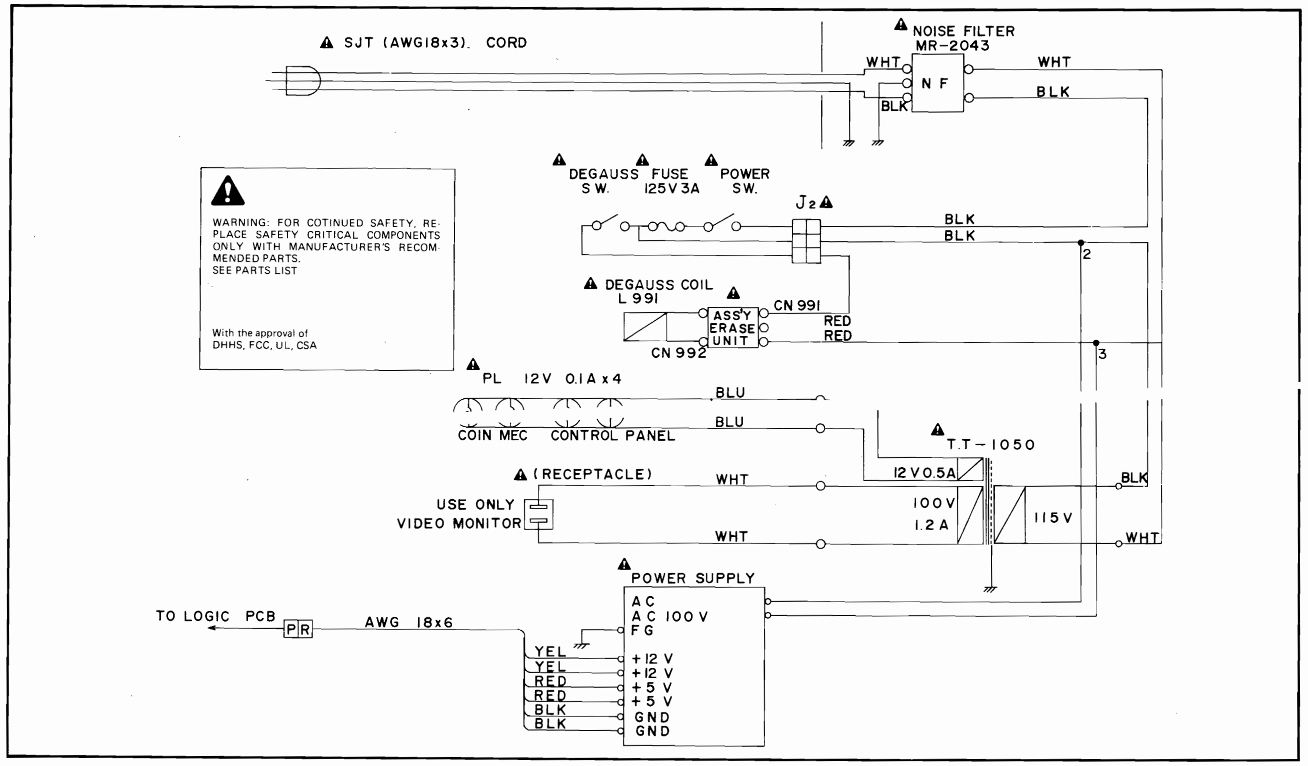


Fig. 12 Power Board Schematic Diagram

B. Credit Control PCB Schematic Diagram

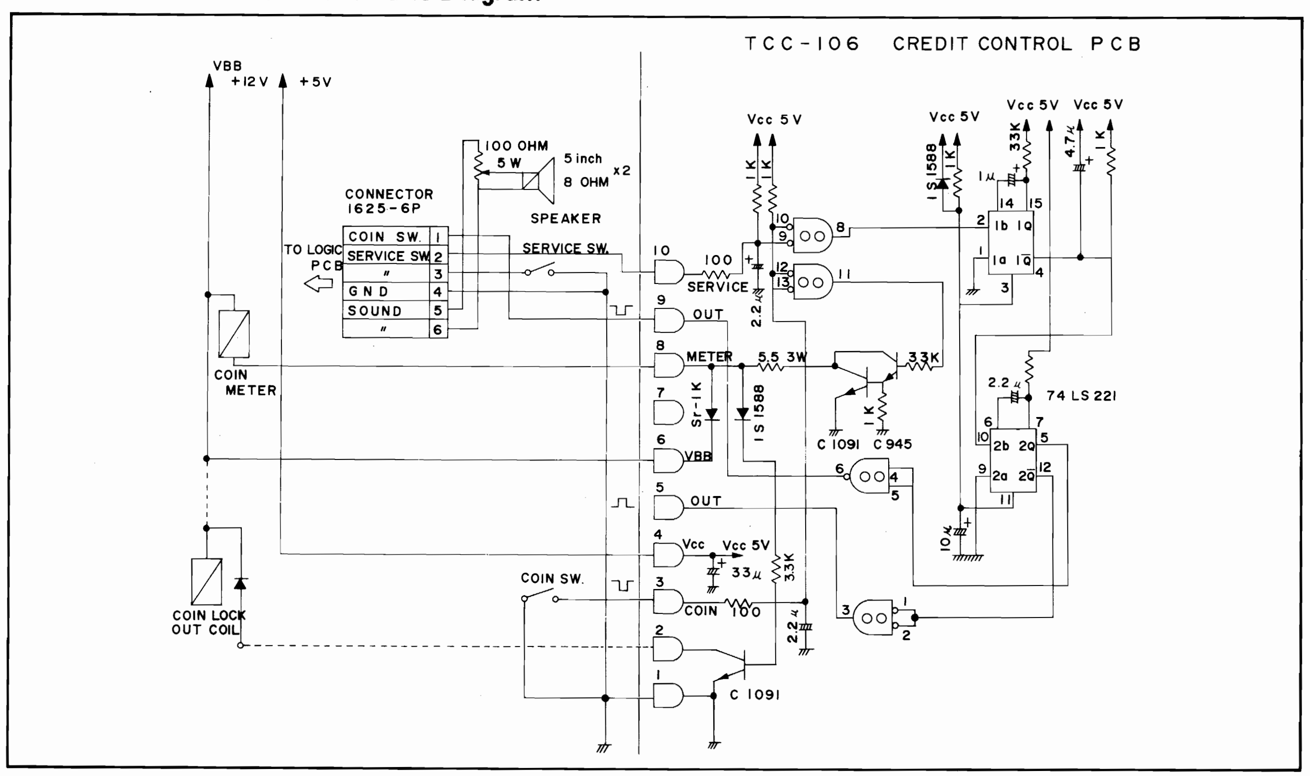


Fig. 13 Credit Control PCB Schematic Diagram

C. Switching Regulator Schematic Diagram

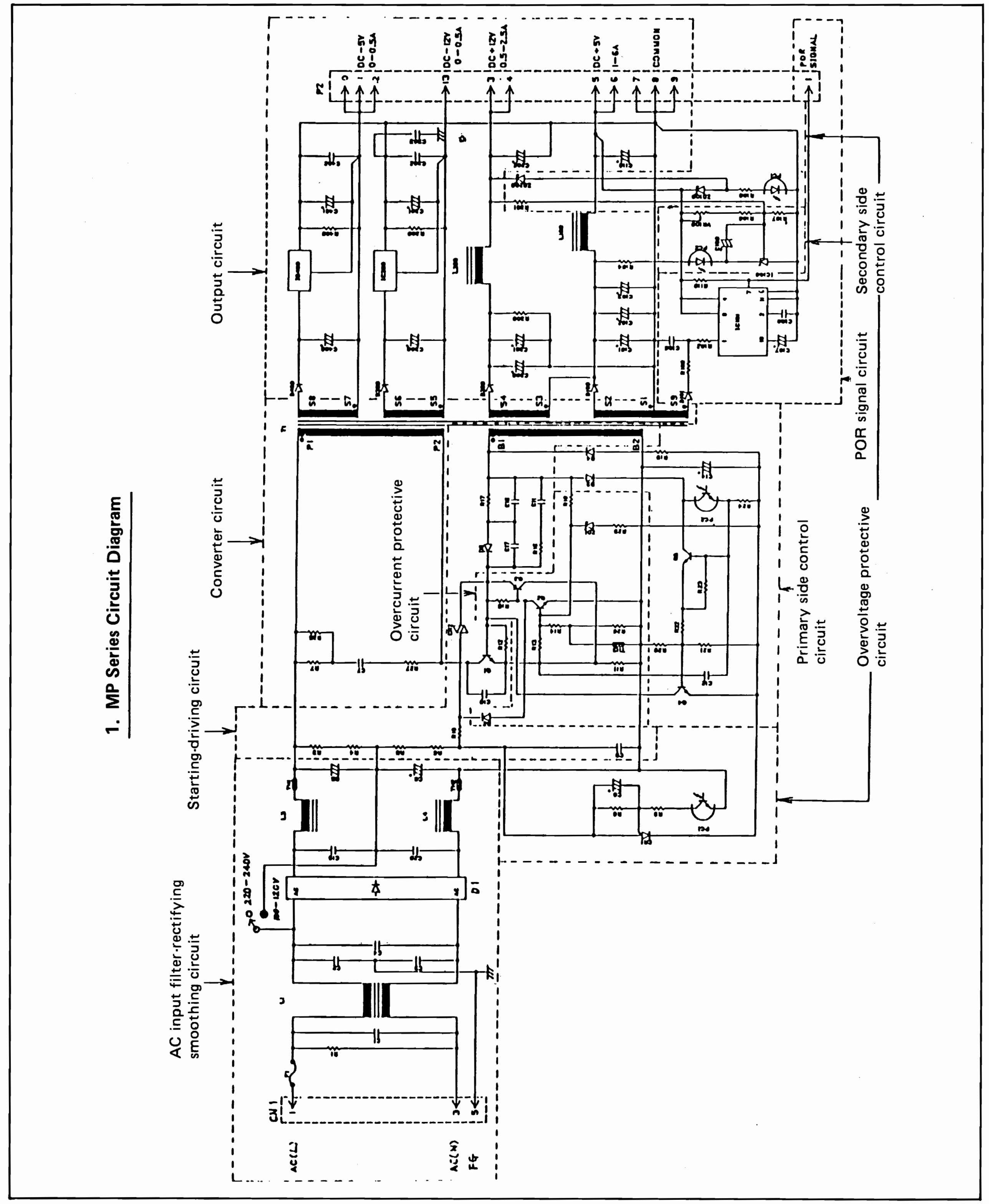


Fig. 14 Switching Regulator Schematic Diagram

12. MAIN PCB IC LOCATION

A. Main PCB IC Location — 1

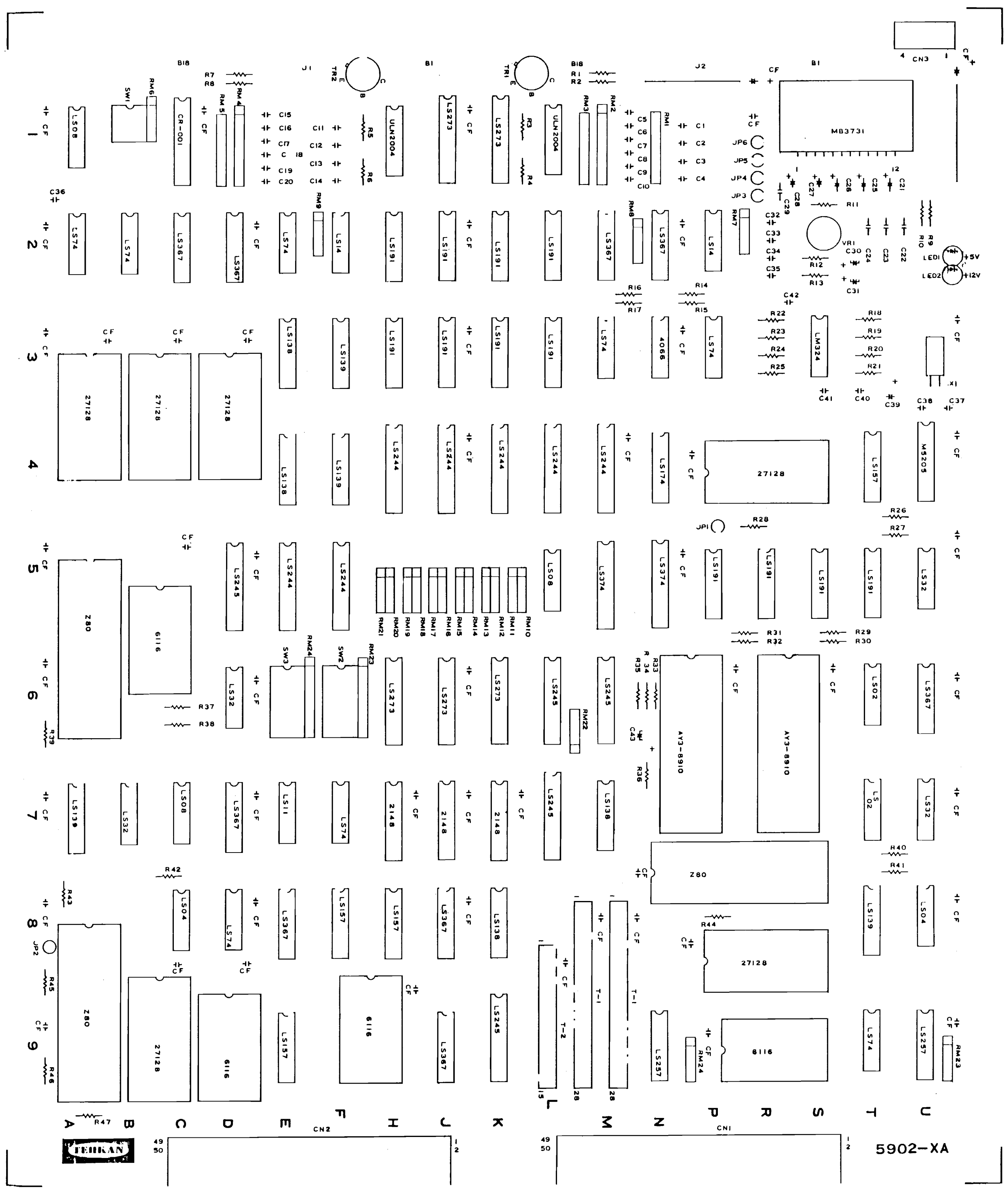


Fig. 15 Main PCB IC Location — 1

B. Main PCB IC Location — 2

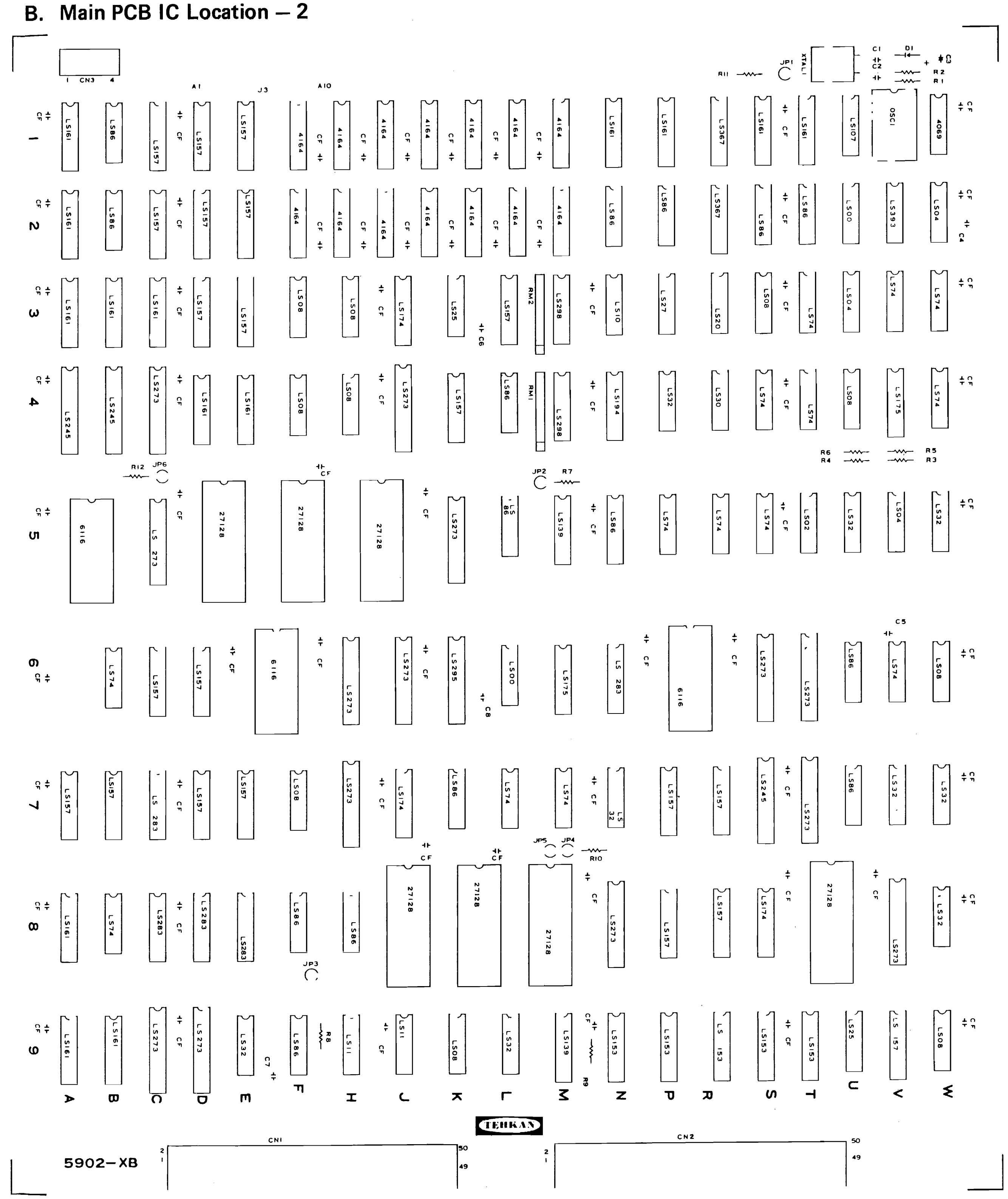


Fig. 16 Main PCB IC Location — 2

13. MAIN PCB PARTS LIST

A. Main PCB Parts List — 1

IC

Item No.	Quantity	Description	Location No.		Parts No.
			5902-XA	5902-XB	
7425	2	TTL		3K, 9U	ET0025
74LS00	2	"	2U	6L	ET1000
74LS02	3	"	6T, 7T	5U	ET1002
74LS04	5	"	8C, 8U	2W, 3U, 5V	ET1004
74LS08	13	"	7C, 5L, 1A	3S, 3H, 3F, 4H, 4F, 4U, 6W, 7F, 9K, 9W	ET1008
74LS10	1	"		3N	ET1010
74LS11	3	"	7E	9J, 9H	ET1011
74LS14	2	"	2P, 2F		ET1014
74LS20	1	"		3R	ET1020
74LS27	1	"		3P	ET1027
74LS30	1	"		4R	ET1030
74LS32	13	"	5U, 6D, 7B	5U, 4P, 5W, 7V, 7W, 8W, 9E, 9L, 7U	ET1032
74LS74	22	"	2A, 2B, 2E, 3M, 3P, 7F, 8D, 9T	3T, 3V, 3W, 4S, 4T, 4W, 5P, 5R, 5S, 6B, 6V, 7L, 7M, 8B	ET1074
74LS86	15	"		1B, 2B, 2μ, 2P, 2S, 4L, 5L, 5N, 5U, 6K, 6U, 8F, 8H, 9F, 2S	ET1086
74LS107	1	"		1U	ET1107
74LS138	4	"	3E, 4E, 7M, 8K		ET1138
74LS139	6	"	3F, 4K, 7A, 8T	5M, 9M	ET1139
74LS153	5	"		9N, 9P, 9R, 9S, 9T	ET1153
74LS157	25	"	4T, 8F, 8H, 9E	1C, 1D, 1E, 2C, 2D, 2E, 3D, 3E, 3L, 4K, 6C, 6D, 7D, 7E, 7P, 7R&P, 8R, 9V, 7A, 7B	ET1157
74LS161	14	"		1A, 1S, 1T, 2A, 3A, 3B, 3C, 4D, 4E, 8A, 9A, 9B, 1M, 1N	ET1161
74LS174	4	TTL	4N	3J, 7J, 8S	ET1174
74LS175	2	"		6M, 4V	ET1175
74LS191	12	"	2H, 2J, 2K, 2C, 3H, 3J, 3K, 3L, 3P, 3R, 3S, 3T		ET1191
74LS194	1	"	4N		ET1194
74LS244	7	"	4H, 4J, 4K, 4L, 4M, 4E, 4F		ET1244
74LS245	9	"	5D, 6L, 6M, 7L, 9K	4A, 4B, 6K, 7S	ET1245
74LS257	2	"	9N, 9U		ET1257
74LS273	19	"	1J, 1K, 6H, 6J, 6K	4J, 4C, 5C, 5K, 6H, 6J, 6S, 6T, 7H, 7T, 8N, 8V, 9C, 9D	ET1273
74LS283	5	"		6N, 7C, 8C, 8D, 8E	ET1283
74LS298	2	"		3M, 4M	ET1298
74LS367	11	"	2C, 2D, 2M, 2N, 7D, 8E, 8J, 9J, 6U	1R, 2R	ET1367
74LS374	2	"	5M, 5N		ET1374
74LS393	1	"		2V	ET1393
27128	12	EPROM 16KByte	3A, 3B, 3D, 4PR, 8PR, 9BC	5DE, 5F, 5J, 8J, 8KL, 8M	EM0128
6116	6	RAM 2KByte	6BC, 9D, 9FH, 9PRS	6F, 6P	EM1016
6116 (120Ns)	1	RAM 2KByte		5A	EM1116
2148	3	RAM 4KBit	7H, 7J, 7K		EM1101
4164	14	DRAM 64KBit		1F~1M, 2F~2M	EM1064
Z80A	3	8 Bit CPU	56AB, 8N, 89AB		EP0080
4066	1	CMOSIC Analog SW.	3N		ECS4066
4069	1	CMOSIC Inverter		1W	ECS4069
ULN2004	2	Transistor Array	1L, 1H		ET2004
LM324	1	OP. AMP	3S		ELC0324
MB3731	1	Power Amplifier	1T		ELC3731
YM2149	2	PSG	6N, 6R		ESS2149
MSM5205	1	Voice Synthesizer	1U		ESS5205
CR-001	1	Custom IC	1C		CR-001
T-1	2	Hybrid IC	1M, 1M		T-1
T-2	1	Hybrid IC	1L		T-2

Resistor

Rating	Quantity	Description	Location No.		Parts No.
			5902-XA	5902-XB	
1kΩ VR	1		VR1		EVR0001
1/4W 47Ω	2	Carbon		R4, R6	ER14470
" 100Ω	3		R1, R7, R8		ER14101
" 330Ω	3		R38, R43, R44		ER14331
" 470Ω	4		R29	R3, R5	ER14471
" 1kΩ	21		R4, R6, R10, R28, R30, R31, R32, R33, R34, R35, R39, R40, R41, R45, R46, R47, R37	R8, R10, R11, R12	ER14102
" 2kΩ	3		R3, R5, R18		ER14202
" 4.7kΩ	3		R23, R24, R36		ER14472
" 9.1kΩ	1		R20		ER14912
" 10kΩ	9		R12, R13, R15, R21, R22, R25, R27, R42	R2	ER14103
" 22kΩ	1		R14		ER14223
" 47kΩ	1		R16		ER14473
" 100kΩ	2		R11, R17		ER14104
" 680kΩ	1		R19		ER14684
" 1MΩ	1			R1	ER14105
Resistor Array					
510Ω x 4	6	5 Pin	RM10, RM12, RM14, RM16, RM18, RM20		ERA5511
1kΩ x 4	7	5 Pin	RM6, RM7, RM8, RM9, RM25, RM26, RM22		ERA5102
2.2kΩ x 4	6	5 Pin	RM11, RM13, RM15, RM17, RM19, RM21		ERA5222
1kΩ x 8	4	9 Pin	RM2, RM4, RM23, RM24		ERA9102
4.7kΩ x 8	2	9 Pin		RM1, RM2	ERA9472
100Ω x 4	3	8 Pin	RM1, R3, RM5		ERA8101

B. Main PCB Parts List — 2

Transistor & Diode

Item No.	Quantity	Description	Location No.		Parts No.
			5902-XA	5902-XB	
2SC2320	2	Transistor	1H, 1L		ETR2320
LED	2	LED	2U, 2U		ELD0003
1S1588	1	D100E		1V	ED1588

Capacitor

Rating	Quantity	Description	Location No.		Parts No.
			5902-XA	5902-XB	
16V/1,000μF	4	Chemical	DE Coupling	DE Coupling	EC16102
16V/100μF	3	"	C21, C25, C26		EC16101
16V/10μF	7	"	C27, C28, C30, C31, C39, C43	C3	EC16100
12V/50pF	1	Ceramic		C37	EC12500
12V/100pF	12	"	C11~C14, C32~C35, C38	C1, C2, 5P	EC12101
12V/0.01μF	3	"	C36, C41, C29		EC12103
12V/0.022μF	1	"	C40		EC12223
12V/0.1μF	126	"	C1~C9, C15~C20, DE Coupling		EC12104
0.15μF	3	Film	C23, C24, C25		EC50154

MISC

Name	Quantity	Description	Location No.		Parts No.
			5902-XA	5902-XB	
Dip SW 8P	2	8 SWS	SW2, SW3		ESW008
Dip SW 4P	1	4 SWS	SW1		ESW004
Xtal 18.432MHz	1	OSC Device			EOS186
OSC 3.0MHz	1	Ceramic OSC			EOS036
IC Socket					
18P	4	18 Pin	7H, 7J, 7K, 4U		ESK18
24P	2	24 Pin	9FH	5AB	ESK24
28P	12	28 Pin	3A, 3BC, 3O, 4P, 8P, 9BC	5DE, 5F, 5H, 8KL, 8M, 8TU	ESK28
40P	3	40 Pin	56A, 8N, 89A		ESK40
Heat Sink		For MB3731			EH5902
Flat Cable	2	50 Pin			EFC5902
Header	2	50 Pin			EHR5902

Other Parts

Name	Quantity	Description	Parts No.
EMI Shield PCB	1	Assembly	MOTHE02
Components			
EMI Filter	MAX 45	DSS310-55B222M	EMS222
"	MAX 8	DSS310-55B101M	EMS101
36 Pin Connector	2	KEL1150-36-029	EMC036
20 Pin Connector	1	KEL1150-20-029	EMC020
Photo PCB	4	Assembly	PH5902
7 Segment LED PCB	4	Assembly	P7L5902
Connectors			
For Harness	2	Molex 1625-24R	HCM024
	1	Molex 1292-9P	HCM009
	1	Molex 1625-6R	HCM006
	1	Molex 1625-5R	HCM005
	4	S2P-SHF-1	HCJ002
	8	S4P-SHF-1	HCJ004
	4	S12P-SHF-1	HCJ012
	2	S15P-SHF-1	HCJ015
	2	KEL1150-036-009 (EDGE Connector)	HCK036
Lamp PCB	2		PLA5902
Lamp	2	12V AC	LA12AC

50 Pin Flat Cable Signal Name

GND	1	2	GND
"	3	4	"
"	5	6	"
+5V	7	8	+5V
"	9	10	"
"	11	12	"
"	13	14	"
TSEL	15	16	PCBSEL
4MCK	17	18	SSW
MSW	19	20	SBSEL*
MNSEL	21	22	SBSEL
EGCONT	23	24	CSEL
SSE8	25	26	SSE0
SSD8	27	28	SSD0
257EG	29	30	HFL
VFL	31	32	MSE0
SWR	33	34	CSE8
CSE0	35	36	CSD0
CSD8	37	38	CSC8
MSE8	39	40	MSD8
MSD0	41	42	MSC8
SDO0	43	44	SDO1
"' 2	45	46	" 3
" 4	47	48	" 5
" 6	49	50	" 7

SAB0	1	2	SAB1
" 2	3	4	" 3
" 4	5	6	" 5
" 6	7	8	" 7
" 8	9	10	" 9
" 10	11	12	SWAIT
MWAIT	13	14	4MHZ
Reset	15	16	VBL
MF86R	17	18	1H
Reset BUF	19	20	COLOCK
DISP	21	22	VBL
SRD	23	24	EVENWR
ODDWR	25	26	CWRITEEV
CWRITEOD	27	28	HBL
CR0	29	30	CR1
" 2	31	32	" 3
" 4	33	34	" 5
" 6	35	36	" 7
" 8	37	38	" 9
MNSEL*	39	40	8H
+5V	41	42	+5V
"	43	44	"
GND	45	46	GND
"	47	48	"
"	49	50	"

14. POSITION OF CONNECTOR

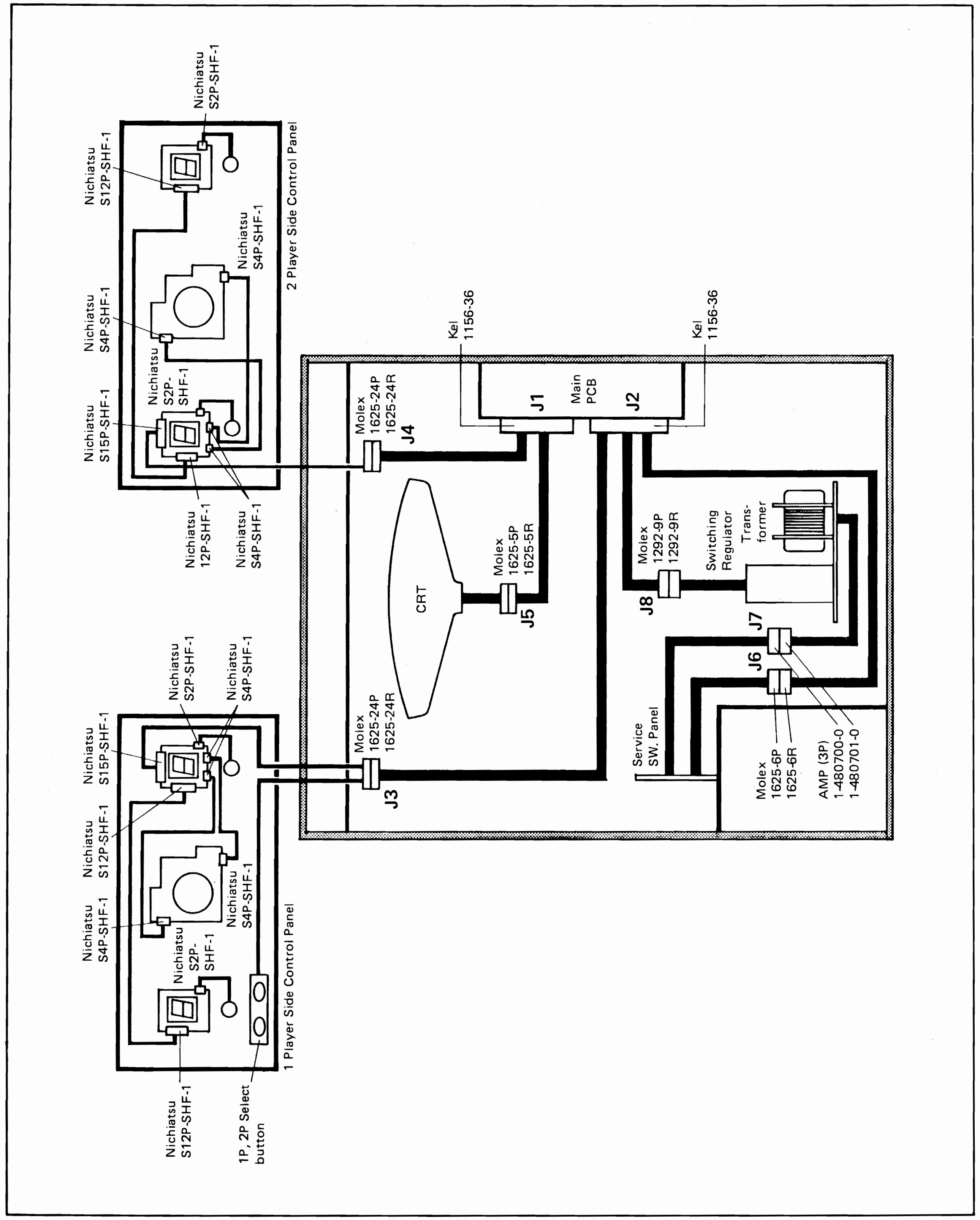


Fig. 17 Position of Connector

15. WIRING

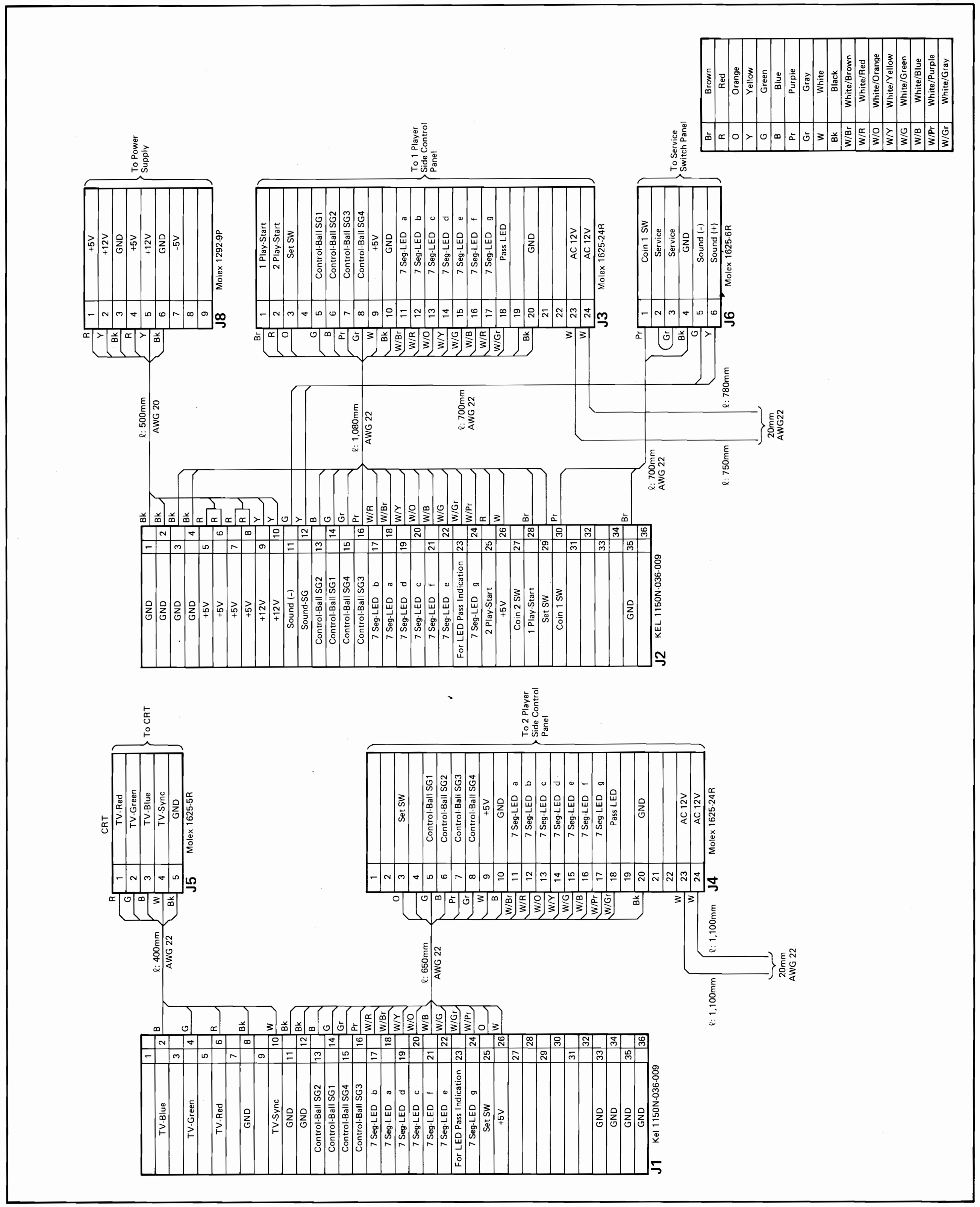


Fig. 18 Wiring

16. BLOCK DIAGRAM

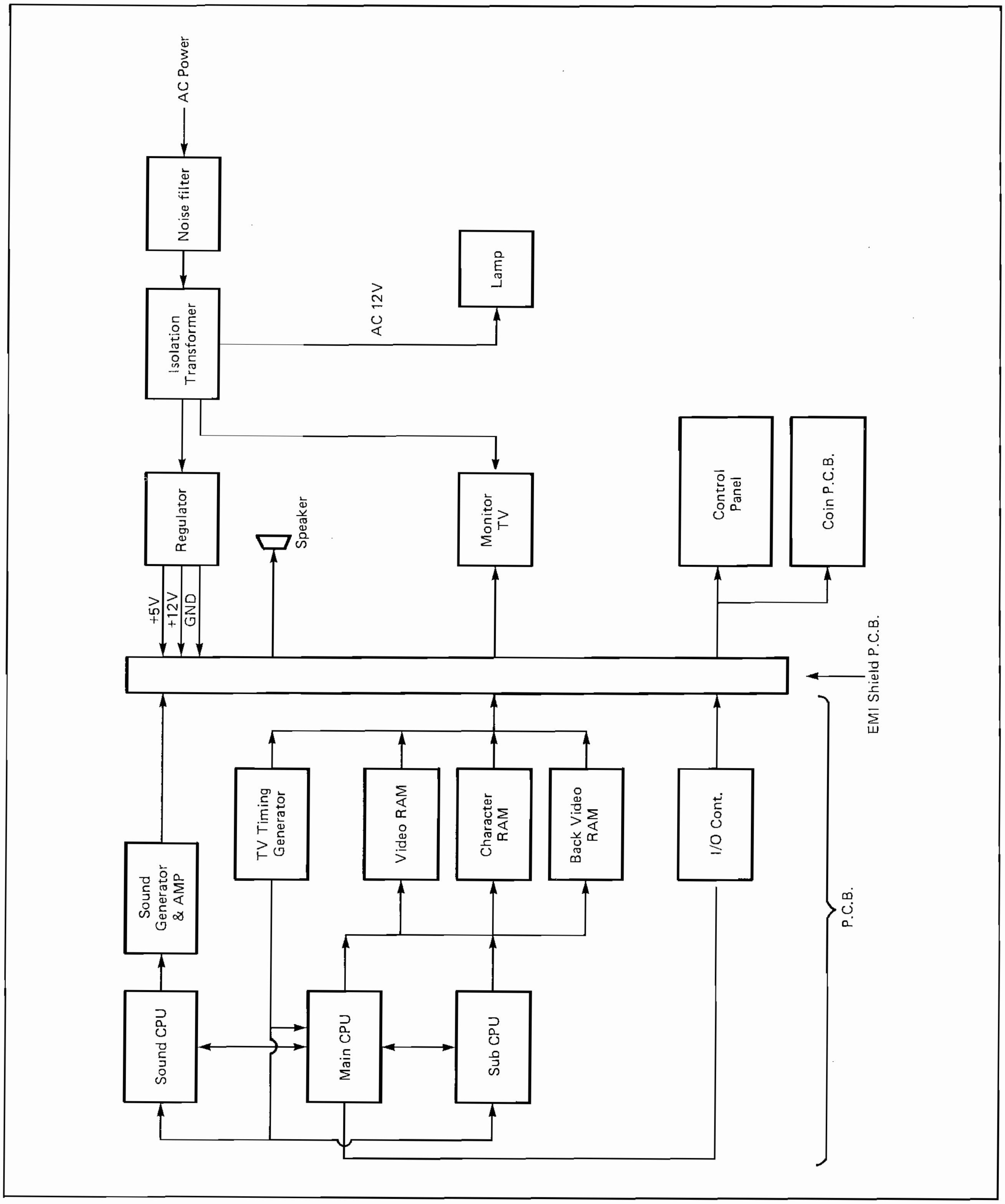


Fig. 19 Block Diagram

CRT

⚠ WARNING ⚠

FOR CONTINUED SAFETY.

Replace Safety critical components only with manufacturer's recommended parts.

To avoid possible electrical shock hazard, unplug the game prior to performing adjustment or repair of CRT.

1. PRODUCT SPECIFICATIONS

(1) Input Unit

- Power Input

a) Plug	:	2-pin AC plug (AC cord)
b) Input voltage	:	100V AC b10%, 50/60Hz
c) Power consumption	:	about 50W

Note: The AC input and chassis are not insulated from each other. Use this color monitor via an isolation transformer which can obtain the following secondary voltage.

[Insulation transformer specification]
140 DC ±5V smoothed by a 680μF capacitor after being fullwave rectified.
Conditions : 600mA DC load
100V AC input

- Signal Input

a) Plug	:	AMP 6-pin connector 171825-6
b) Kinds of signals	:	R·G·B is positive and TTL level SINC is composite.

<table>
<tr><th>Connector pin No.</th><th>Input signal</th><th>Standard specifications</th><th>Changeable specifications</th></tr>
<tr><td>1</td><td>Vertical synchronizing signal (See *1)</td><td></td><td rowspan="2">Separate synchronization TTL level
<table><tr><th></th><th>1</th><th>2</th><th>3</th></tr><tr><td>Vertical synchronizing polarity</td><td>Positive</td><td>Positive</td><td>Negative</td></tr><tr><td>Horizontal synchronizing polarity</td><td>Positive</td><td>Negative</td><td>Negative</td></tr></table></td></tr>
<tr><td>2</td><td>Horizontal synchronizing signal (See *2)</td><td>Negative polarity, composite synchronization
0.5Vp-p ~ 5Vp-p</td></tr>
<tr><td>3</td><td>Earth</td><td>Earth</td><td>Earth</td></tr>
<tr><td>4</td><td>Blue video signal</td><td>Positive polarity
White level :
Lower than 5V DC
Black level :
Higher than 0V DC
2.5Vp-p ~ 5Vp-p</td><td>Negative polarity
White level :
Higher than 0V DC
Black level :
Lower than 5V DC
3Vp-p ~ 5Vp-p</td></tr>
<tr><td>5</td><td>Green video signal</td><td>Same as specified above.</td><td>Same as specified above.</td></tr>
<tr><td>6</td><td>Red video signal</td><td>Same as specified above.</td><td>Same as specified above.</td></tr>
</table>

*1. Vertical synchronizing signal
- Frequency : 50Hz ~ 60Hz
- Pulse width : 190μS (=3TH) ~ 500μS (=8TH)

*2. Horizontal synchronizing signal
- Frequency : 15.75kHz
- Pulse width : 3μS ~ 7μS

- Power Input for Demagnetization
  - a) Plug : 2.36φ 3-pin connector YP115S-3P (made by JARCO)
  - b) Input voltage : 100V AC ±10%
  - c) Input current : About 12A when power was turned on. Lower than 10mA under steady-state condition.

(2) Display Unit

- Display Tube : 20″90° deflection, color CRT 510WKB22
- Scanning : TV scanning system

(3) Electrical Performance

- Video amplifier
  - a) Video amplification again : Better than 30 dB
  - b) Frequency characteristic : Better than 6MHz (at -3dB)
- Synchronizing Unit
  - a) Lock in range on horizontal synchronization : 15.75KHz ±300Hz
  - b) Lock in range on vertical synchronization : Better than 6Hz

- CRT Screen
  - a) Non-linearity of raster
    - Horizontal — Within 8%
    - Vertical — Within 8%
  - b) Raster distortion
    - Trapezoidal distortion — Within 3%
    - Barrel/pincusion distortion — Within 3%
    - Tilting — Within 2°
  - c) Misconvergence

    Within a circle having a dia- less than 0.8 mm corresponding to 80% of vertical length of CRT.

    Within a circle having a dia- less than 1.2 mm equivalent to vertical length of CRT (excluding the above circle).

    Within CRT screen (excluding less than 1.6 mm the above circles).
  - d) Color purity

    Purity should be maintained. No trouble shall arise on the visual sense when applying video signals after demagnetization using a bar demagnetizer.

    Condition: Within Japanese terrestrial magnetism. CRT Fluorescent screen facing upward.
  - e) Resolution
    - Horizontal — Better than 320 TV lines
    - Vertical — Better than 320 TV lines (during interlace)

(4) Adjustment Functions

Arrangement	Kinds of control knobs
Front face of main PCB	Brightness (BRIGHT), Vertical position (V. POSITION) Vertical size (V. SIZE), Vertical hold (V. HOLD) Horizontal hold (H. HOLD), Horizontal size (H. SIZE) Horizontal position (H. POSITION)
Inside main PCB	Video amplifier bias (VIDEO-BIAS) Red signal gain (R-GAIN), Green signal gain (G-GAIN) Blue signal gain (B-GAIN) Horizontal size selector tap (NARROW ↔ WIDE)
CRT PCB	Red signal potential (R-BIAS) Blue signal potential (B-BIAS) Green signal potential (G-BIAS)
Rear face of cabinet	Focus (FOCUS), Screen (SCREEN)

(5) **Environmental Conditions**

• Working conditions	: Temperature; 0°C ~ 40°C Relative humidity; Less than 70%
• Storage conditions	: Temperature; 10°C ~ 60°C Relative humidity; Less than 80%
• Drop resistance	: 50 cm
• AC line noise resistance	: No asynchronized condition shall be detected when applying 500Vp-p using a noise simulator.
• Vibration resistance	: No abnormal symptom shall appear when applying vibrations having the maximum acceleration of 1G for 30 minutes.

2. IMPORTANT SERVICE SAFETY IMFORMATION

The +B Adj. Control (R910) in this Monitor is sealed in order to protect against X-ray radiation. But in case some parts, that is R908, R909 and D905 have to be replaced, R910 should be renewed with them and readjusted. Adjust the voltage at TP-2 terminal to 102 ±1V DC. After adjustment, seal the hole and movable elements of R910 with silicon rubber KE-48RTV (Shinetsu Chemical). If components are replaced on power circuit block, check that the +B voltage is within specifications after repair.

Certain H.V. failures can increase X-ray radiation. Monitors should not be operated with H.V. levels exceeding the specified rating for their chassis type. The maximum operating H.V. specified for the chassis used in these monitor is 25.0 ±1.0KV at Zero beam current with an input voltage of 100V AC. Higher voltage may also increase possibility of failure in H.V. supply.

It is important to maintain specified values of all components in the horizontal and high voltage circuit and anywhere else in the monitor that could cause a rise in high voltage or operating supply voltage. No change should be made to the original design of the monitor.

Components shown on the schematic diagram identified in the replacement parts list should be replaced only with exact factory recommended replacement parts. The use of unauthorized substitute parts may create X-ray radiation.

Symbol No.		Description
D905	Zener Diode	HZ7B/MZ307-B/ EQA01-07S/RD6.8E-B3/ RD7.5E-B1
IC401	IC	HA11235
R908	R-Carbon	68 Kohm-J ¼W
R909	R-Carbon	4.7 Kohm-J ¼W
R910	R-Semifixed	3 Kohm
R513	R-Metal	910 ohm-F ¼W
R514	R-Metal	150 Kohm-F ¼W
R517	R-Metal	3.3 Kohm-J 3W
C510	C-Electro	1μF-M 50V
C520	C-Polypro	0.47μF-M 200V

Symbol No.		Description
C514	C-Polypro	2200pF-J 1.6KV
C-515	C-Polypro	2200pF-J 1.6KV
C516	C-Polypro	2200pF-J 1.6KV
C517	C-Polypro	1000pF-J 1.6KV/
	C-Ceramic	1000pF-K 2KV
L503	Coil (Liner)	4F16076AA/4F16076AB
L504	Coil (Size)	5F16005A1
L801	Defl.-Yoke	YS-53698 (5F18014A1)
V801	C.R.T.	510WUB22
T503	F.B.T	MSH1FFAC13 (5F13011A1)
TT1050	Transformer	E-02-017

3. HOLD-DOWN OR SAFETY CIRCUIT INFORMATION

This model employs hold-down circuit as the horizontal oscillator is made to stop in case +B voltage is raised for any reason.

- Circuit diagram

  Hold-down circuit consists of IC, resistors and capacitor; Circuit diagram of hold-down is attached to Figure I-1.

- Description of hold-down circuit
  - a) High voltage rising in this chassis is made by horizontal output pulse rising.
  - b) This circuit consists of circuit mechanism in which the horizontal oscillator is stopped by increase of +B.
  - c) Once +B increases by a power supply circuit failure, some voltage is added to IC401 through resistor R514 from +B.
  - d) IC401 has characteristics in which the horizontal oscillator is stopped if some voltage is added to No. 9 pin.
  - e) In such operation, this chassis does not create a high voltage which will exceed 0.5 mR/h X-radiation exposure under any condition of component failure.

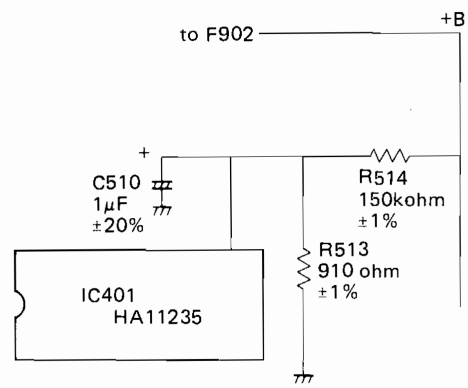


Fig. 1 Hold-down Circuit Diagram

4. CAUTIONS ON USE

(1) Impact

Don't give any impact to the color monitor during transportation, otherwise, a trouble may result. The shipping package is durable against a drop of 500 mm. However, if the package drops from a height of exceeding 500 mm, it may be damaged.

(2) High Voltage

Never touch the interior of the color monitor carelessly, since a very dangerous high voltage of exceeding 20,000V is produced inside the color monitor.
Disconnect the plug from its plug socket before touching the interior.

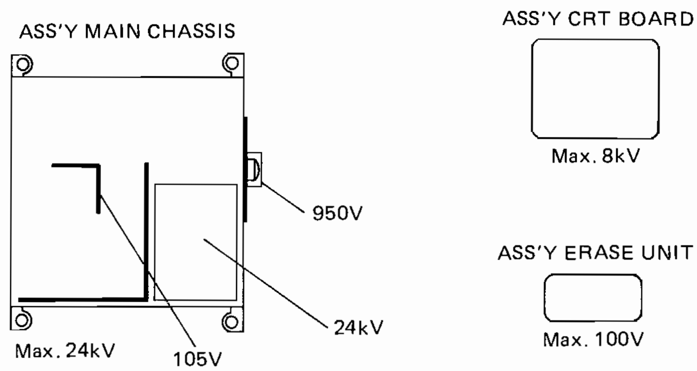


Fig. 2 High Voltage

(3) Control Knobs

Don't manipulate control knobs needlessly. Entrust a skilled technicial with their adjustments. If these control knobs are adjusted at random, the instrument may malfunction after a prolonged use. For detailed adjustments, refer to the separate adjustment and check procedures.

(4) High-Temperature Section

If solder refuse or paper scraps remain unremoved from the interior of the color monitor, they may cause a trouble, electric shock, and/or a fire.
Particularly be careful with the ingress of these foreign substances due to a practical joke of customers.

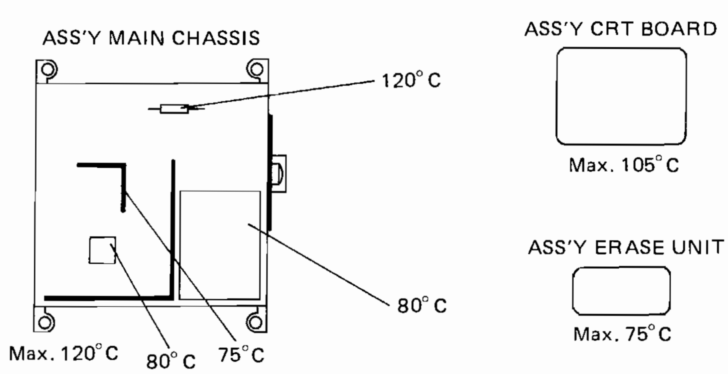


Fig. 3 High-temperature Section

(5) **Troubles**
If abnormal noise, smoke, or unusual odor is detected, turn off the power switch, and also disconnect the plug from the wall socket. If the instrument is operated as it is, unexpected trouble may result.

(6) **Magnetism**
Magnetism causes the disturbance of colors. Don't allow any magnet or speaker to be close to the color monitor.
Even if it approaches the instrument, it will not cause trouble, but the picture may be colored or distorted.

(7) **Static Electricity**
If you touch the CRT surface, you may feel a very weak electric shock. This is caused by the static electricity being produced on the CRT surface, and it does not affect the human body.

5. ADJUSTMENT AND CHECK PROCEDURES

A. **Screen Voltage Adjustment**

(1) **Meter**
- Digital voltmeter .... VHP TR 6854

(2) **Connection Diagram**

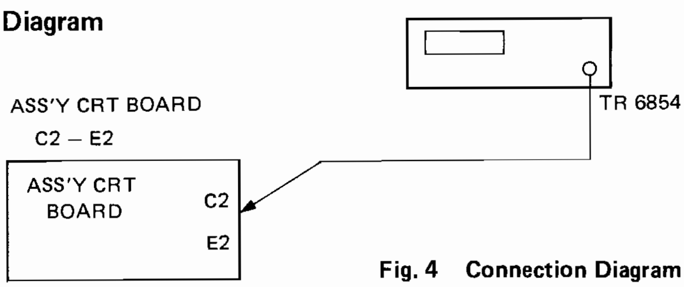


Fig. 4 Connection Diagram

(3) **Adjusting Method**
- Connect the digital voltmeter between G2 and E2 of the CRT board assembly, and adjust the screen control knob until the meter reads 210V.

(4) **Standards**
- 210 ±10V

(5) **Adjusting Conditions**
- Power voltage .... Rated voltage ±2%
- RV503 .... Max (fully clockwise)

(If individual adjustment and check procedure is given, it takes precedence over the other instructions.)

B. Control Knob Adjustments

(1) Adjustment Condition

- Power voltage .... Rated voltage ±2%
- RV 101 ~ 3, RV 301 ~ 3 .... About center (white raster)
- RV 503 .... 1k = 600μA

(2) RV 401

- V.HOLD control knob (VR)
- Turn this VR clockwise and counterclockwise to set it to about the center of the lock in range on vertical synchronization.
- No asynchronization shall occur when turning on and off the power switch.

(3) RV 501

- H.HOLD control knob (VR)
- Turn this VR clockwise and counterclockwise to set it to about the center of the lock in range on horizontal synchronization.
- No asynchronization shall occur when turning on and off the power switch.

(4) RV 402

- V. POSITION control knob (VR)
- Turn this VR clockwise and counterclockwise until the video display size is positioned at the center of CRT screen.

(If individual adjustment and check procedure is given, it takes precedence over the other instructions.)

(5) RV 502

- H. POSITION control knob (VR)
- Turn this VR clockwise and counterclockwise until the video display size is positioned at the center of CRT screen.

(If individual adjustment and check procedure is given, it takes precedence over the other instructions.)

(6) RV 403

- V. SIZE control knob (VR)
- Set this VR to 104% scan (4% overscan).

(If individual adjustment and check procedure is given, it takes precedence over the other instructions.)

(7) FOCUS

- FOCUS control knob (VR)
- Turn this VR until an optimum focus condition is obtained.

(8) L 504

- Horizontal size adjusting coil
- Adjust this coil to 104% scan (4% overscan)

(If individual adjustment and check procedure is given, it takes precedence over the other instructions.)

C. **ITC Adjustment**

(1) **Adjusting Conditions**

- Power voltage .... Rated voltage ±2%
- RV 503 .... About center
- RV 101 ~ 3 .... About center
- Other control knobs .... Adjusted, in advance
- Demagnetize CRT fixtures, shadow mask, and other metallic parts by degaussing coil (HOZAN (HC-21).

(2) **Purity Adjustment**

- After bringing the deflecting yoke toward the CP magnet, turn RV 301 fully counterclockwise (MIN), turn RV 302 fully clockwise (MAX), and also turn RV 303 fully counterclockwise (MIN) to obtain a green screen.

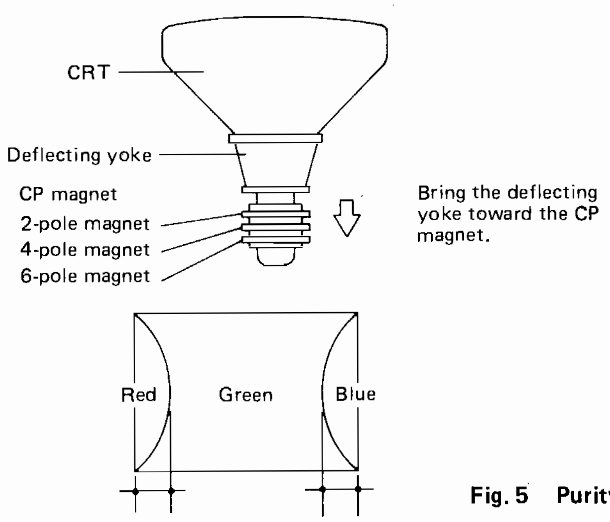


Fig. 5 Purity Adjustment – 1

- Adjust the 2-pole magnet of CP magnet until red and blue are almost equal to each other (a=b).
- Gradually shift the deflecting yoke upward and temporarily fix it at a point where no uneven color appears at four corners.

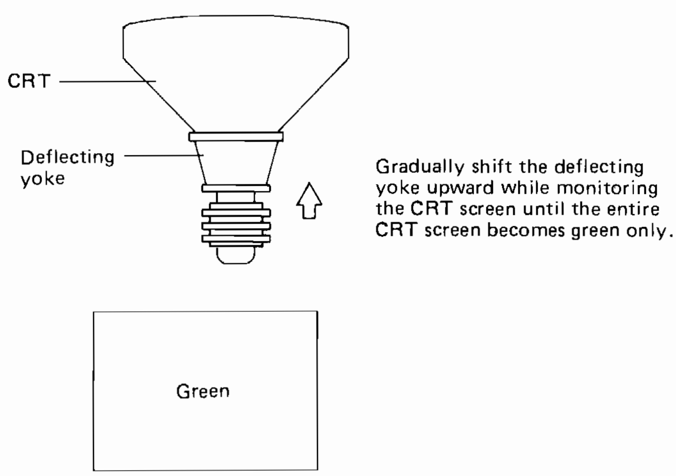


Fig. 6 Purity Adjustment – 2

- Obtain an optimum beam landing condition through a microscope.

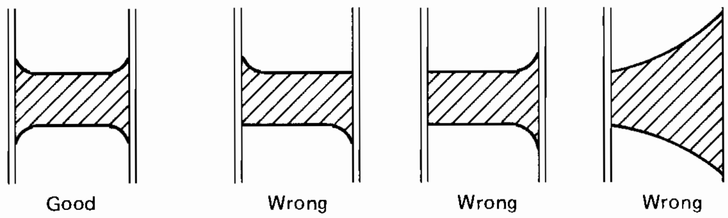


Fig. 7 Purity Adjustment – 3

- Fix the deflecting yoke after confirming the above items.

(3) Static Convergence Adjustment

- Obtain a cross hatch pattern.
- Turn RV 301 fully clockwise (MAX), turn RV 302 fully counterclockwise (MIN), and also turn RV 303 fully clockwise (MAX) to obtain a magenta screen.

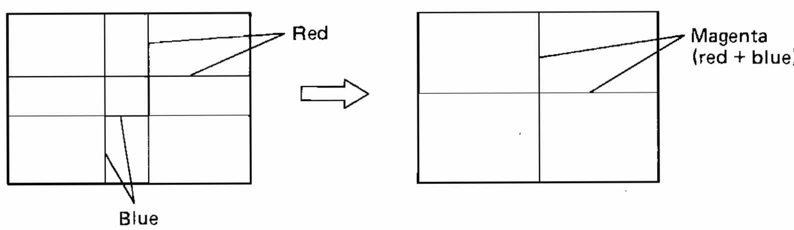


Fig. 8 Static Convergence Adjustment – 1

- Adjust the 4-pole magnet of CP magnet until red and blue coincide with each other.
- Turn RV 302 fully clockwise (MAX) to emit green also.

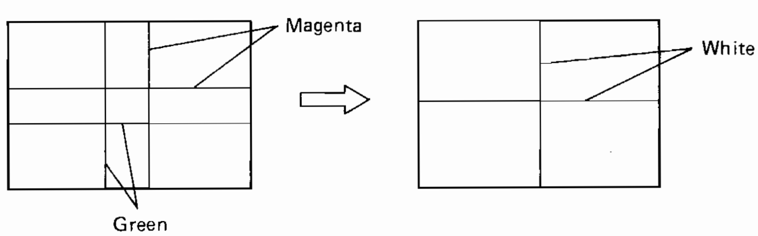


Fig. 9 Static Convergence Adjustment – 2

- Adjust the 6-pole magnet of CP magnet until green coincides with magenta (red + blue).

(4) Dynamic Convergence Adjustment

- Make sure that the static convergence has been adjusted.
- Adjust the deflecting yoke by oscillating it until cross hatches at four corners of CRT intersect each other.
- Fix the deflecting yoke by three wedges.
- Fix the wedges by using a silicon bonding agent, a double-face adhesive tape, or a glass cloth tape.

D. **Video Bias Adjustment**

(1) **Jig and Meter**

- Digital voltmeter .... YHP TR-6854
- DC power supply .... Output 0 ~ 5 (V)

(2) **Connection Diagram**

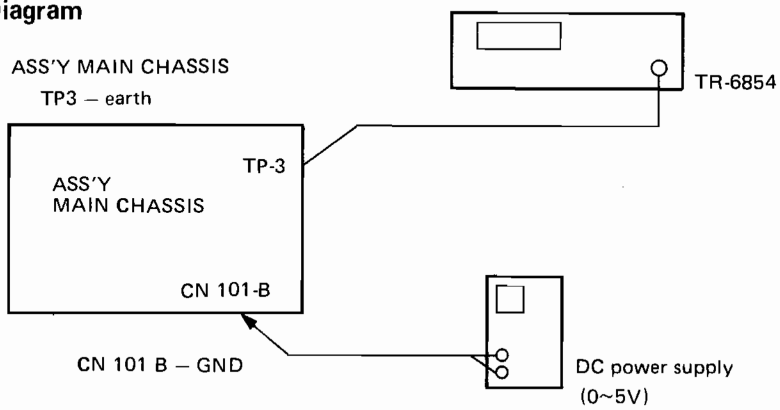


Fig. 10 Connection Diagram

(3) **Method**

Adjust RV 103 and RV 104 until the TP3 potential becomes 6V when the input signal is at the black level and it becomes 10V when the input signal is at the white level.

6. TIMING CHART

(1) **Horizontal Signal**

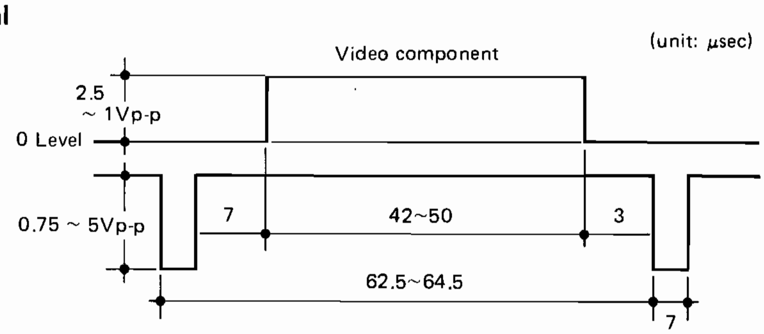


Fig. 11 Horizontal Signal

(2) **Vertical Signal**

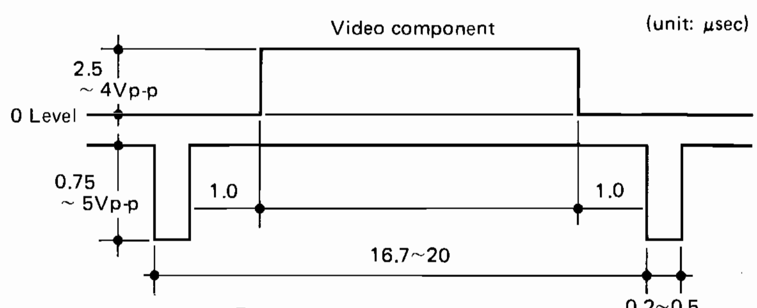


Fig. 12 Vertical Signal

7. OUTLINE OF A'SSY PCB UNITS

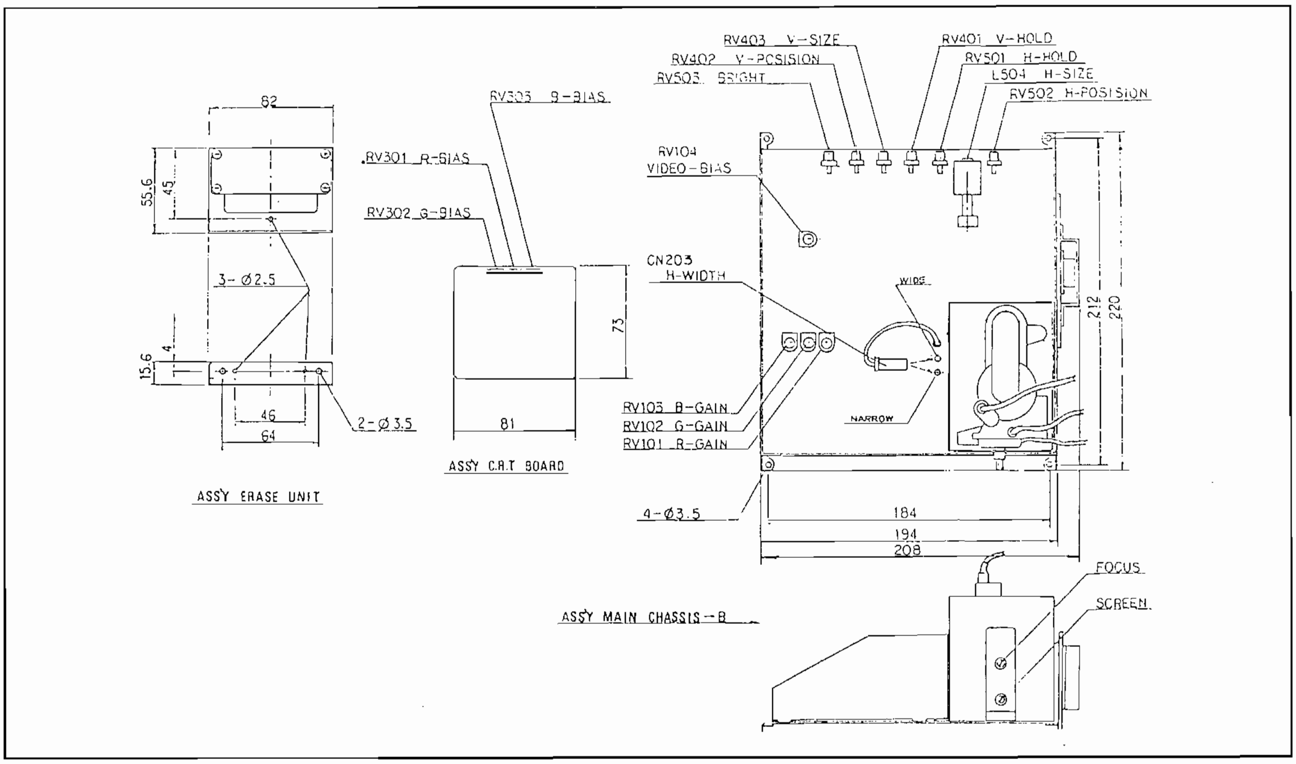


Fig. 13 Out Line of Ass'y PCB Units

8. WIRING DIAGRAM

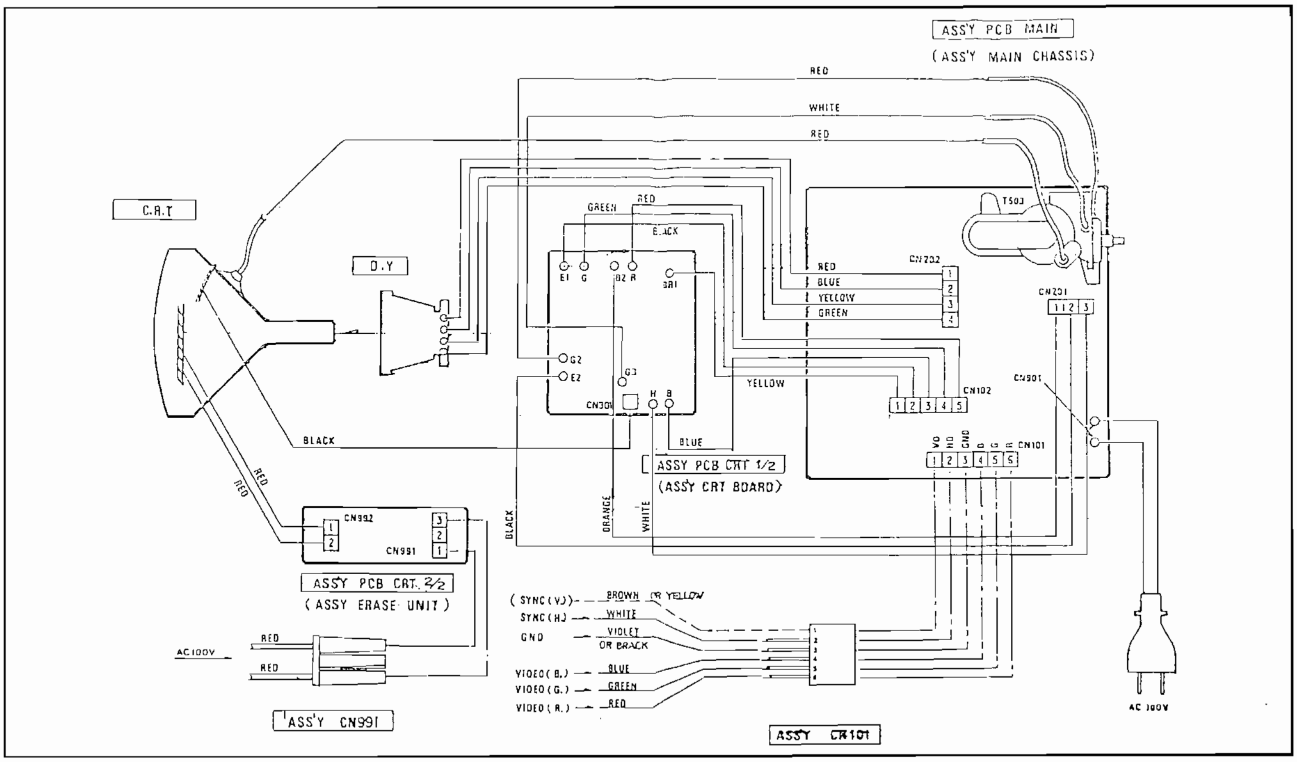


Fig. 14 Wiring Diagram

9. ASS'Y PCB MAIN PARTS LOCATION

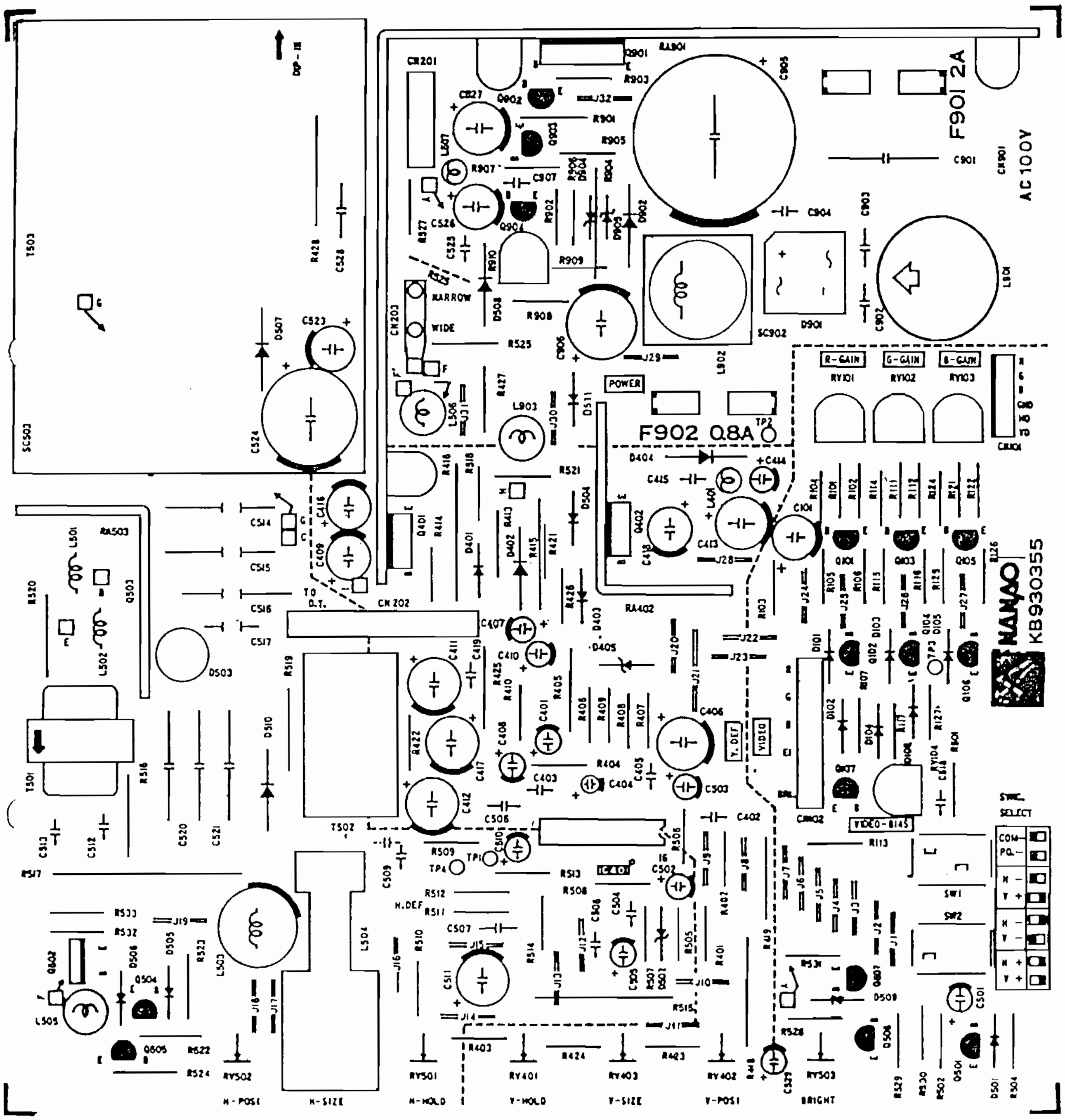


Fig. 15 Ass'y PCB Main Parts Location

10. CRT DISPLAY A'SSY PARTS LIST

Part No.	Description	Specification
R 101	R	1/4SB 680-J
R 102	R	1/4SB 680-J
R 103	R	1/4SB 2.2K-J
R 104	R	1/4SB 390-J
R 105	R	1/4SB 2.2K-J
R 106	R	1/4SB 390-J
R 107	R	1/4SB 1K-J
R 111	R	1/4SB 680-J
R 112	R	1/4SB 680-J
R 113	R-Option	1/4SB 15K-J
R 114	R	1/4SB 390-J
R 115	R	1/4SB 2.2K-J
R 116	R	1/4SB 390-J
R 117	R	1/4SB 1K-J
R 121	R	1/4SB 680-J
R 122	R	1/4SB 680-J
R 123	R	NAS1/4 390-J
R 124	R	1/4SB 390-J
R 125	R	1/4SB 2.2K-J
R 126	R	1/4SB 390-J
R 127	R	1/4SB 1K-J
R 401	R	1/4SB 10K-J
R 402	R	1/4SB 8.2K-J
R 403	R	1/4SB 3.3K-J
R 404	R	1/4SB 8.2K-J
R 405	R	1/2SB 270-J
R 406	R	1/4SB 10K-J
R 407	R	1/4SB 680-J
R 408	R	1/4SB 2.2K-J
R 409	R	1/4SB 12K-J
R 410	R	1/4SB 10K-J
R 413	R-Metal	100-J 1/2W
R 414	R	1/4SB 2.2K-J
R 415	R-Metal	1W 10K-J
R 416	R-Metal	1/2W 22-J
R 417	R-Cement	10W 220-K
R 418	R-Metal	1W 4.7K-J
R 419	R	1/2W 2.2K-J
R 901	R-Fuseble	FMR1/4 330-J
R 902	R	1/4SB 47K-J
R 903	R-Fuseble	FMR1/4 68-J
R 904	R-Metal	1W 15K-J
R 905	R	1/4SB 1M-J
R 906	R	1/4SB 15K-J
R 907	R	1/4SB 68K-J
R 908	R	1/4SB 68K-J
R 909	R	1/4SB 4.7K-J
RV 910	R	3K B
RV-101	R-Variable	V8K-4-1 5K
RV-102	R-Variable	V8K-4-1 5K
RV-103	R-Variable	V8K-4-1 5K
RV-104	R-Option	V8K-4-1 5K
RV-401	R-Variable	RVG-091 5KB
RV-402	R-Variable	RVG091 30KB
RV-403	R-Variable	RVG091 470B
RV-501	R-Variable	RVG91 3KB
RV-502	R-Variable	RVG91 30KB
RV-503	R-Variable	RVG91 30KB
R 910	R-Semifixed	V8K4-1 3K
C 101	C-Electro	16V 100M
C 401	C-Electro	50V 1M
C 402, 403	C-Polyester	50V 333K
C 404	C-Tantal	16V 2.2M

Part No.	Description	Specification
C 405	C-Ceramic	50V 561K
C 406	C-Electro	16V 470M
C 407	C-Electro	25V 10M
C 408	C-Tantal	25V 10M
C 409	C-Electro	100V 10M
C 410	C-Electro	50V 1M
C 411	C-Electro	35V 220M
C 412	C-Electro	6.3V 470M
C 413	C-Electro	16V 470M
C 414	C-Electro	100V 10M
C 415	C-Ceramic	500V 222K
C 416	C-Electro	100V 10M
C 417	C-Electro	35V 220M
C 418	C-Electro	160V 2.2M
C 419	C-Ceramic	500V 222K
C 501	C-Electro	25V 10M
C 502	C-Electro	25V 10M
C 503	C-Electro	50V 1M
C 504	C-Ceramic	50V 222P
C 505	C-Electro	50V 1M
C 506	C-Polyester	50V 423K
C 507	C-Polyester	50V 423K
C 508	C-Polypro	100V 562G
C 510	C-Electro	50V 1M
C 511	C-Electro	16V 220M
C 512	C-Ceramic	500V 561K
C 513	C-Ceramic	500V 472P
C 514	C-Ceramic	1.6KV 222J
C 515	C-Ceramic	1.6KV 222J
C 516	C-Ceramic	1.6KV 182J
C 517	C-Ceramic	950V 821K
C 518	C-Ceramic	50V 821K
C 520	C-Poripro	200V 0.47M
C 523	C-Electro	50V 47M
C 524	C-Electro	160V 47M
C 525	C-Ceramic	500V 222K
C 526	C-Electro	160V 1M
C 527	C-Electro	160V 10M
C 528	C-Poripro	630V 103J
C 529	C-Electro	25V 10M
C 901	C-Polypro	125V UL. 104J
C 902	C-Ceramic	250V 222K
C 903	C-Ceramic	250V 222K
C 904	C-Ceramic	500V 222K
C 905	C-Electro	180V 680M
C 906	C-Electro	160V 22M
C 907	C-Ceramic	500V 221K
L-401	L-Choke	FL7H 101K
L-501	L-Choke	0.47MH
L-502	L-Choke	0.47MH
L-503	L-Linear	LH13P04A
L-504	L-Size	
L-505	L-Choke	FL9H 332J
L-506	L-Choke	302K
L-507	L-Choke	FL5H 501K
L-901	L-Choke	1.5MH
L-902	L-Choke	462K
L-903	L-Choke	302K
T-501	T-H. Drive	
T-503	T-FBT	6F13649A1
T-504	L-Size	6F16050A1
R 421	R	1/4SB 68K-J
R 422	R	1/4SB 6.8-J

Part No.	Description	Specification
R 423	R	1/4SB 470-J
R 424	R-Fuseble	FMR1/4W 4.7-J
R 425	R	1/2SB 390-J
R 426	R	1/4SB 6.8K-J
R 427	R-Fuseble	FMR1/2W 1.2-J
R 428	R-Fuseble	FMR2W 1.2-J
R 501	R	1/4SB 330-J
R 502	R	1/4SB 10K-J
R 504	R	1/4SB 10K-J
R 505	R	1/4SB 27K-J
R 506	R	1/4SB 390K-J
R 507	R	1/4SB 18K-J
R 508	R	1/4SB 68K-J
R 509	R	1/4SB 6.8K-J
R 510	R	1/4SB 10KJ
R 511	R	1/4SB 1.2KJ
R 512	R	1/4SB 470-J
R 513	R-Metal	RNL1W 3.3K-J
R 514	R-Metal	RNL1/4 560K-J
R 515	R-Metal	2W 6.8K-J
R 516	R	1/2SB 8.2K-J
R 517	R-Metal	3W 3.3K-J
R 518	R	1/4SB 8.2K-J
R 519	R	1/2SB 4.7K-J
R 520	R	1/2SB 33-J
R 521	R	1/4SB 10K-J
R 522	R-Fuseble	FMR1/4 330-J
R 523	R-Fuseble	FMR1/4 330-J
R 524	R-Fuseble	FMR1/4 330-J
R 525	R-Fuseble	FMR1/2 4.7-J
R 527	R	1/4SB 22K-J
R 528	R	1/4SB 22K-J
R 529	R	1/4SB 680-J
R 530	R	1/4SB 4.7K-J
R 531	R	1/4SB 470-J
R 532	R	1/4SB 680-J
R 533	R	1/4SB 47-J
Q 101, 102	Transistor	2SC458
Q 103, 104		or 2SC710
Q 105, 106		2SC945
		2SC1740
		2SC1815
		2SC2410
		2SC2724
Q 107	Option	2SA673
		or 2SA695
		2SA933
		2SA950
		2SA952
		2SA1015
Q 401, 402	Transistor	2SD1138
		or 2SC2073
Q 501	Transistor	2SC458
		or 2SC710
		2SC945
		2SC1740
Q 501	Transistor	2SC458
		or 2SC710
		2SC945
		2SC1740
		2SC1815
		2SC2410
		2SC2724

Part No.	Description	Specification
Q 502	Transistor	2SC1749
		or 2SC2456
		2SC2611
		2SC2688
Q 503	Transistor	2SD900B
		or 2SD870
Q 504, 505	Transistor	2SD768
		or 2SD974
		2SC2838
Q 506, 507	Transistor	2SA678
		or 2SA695
		2SA933
		2SA950
		2SA952
		2SA1015
D 101	Diode	1S2076
D 102		or 1S1588
D 103		or 1S953
D 104		or 1S2473
D 105		
D 106		
D 401	Diode	1S2076
		or 1S1588
		or 1S953
		or 1S2773
D 402	Diode	RM1Z
		or 1S1886
		SIB12-02
D 403	Diode	1S2076A
		or 1S1553
		or 1S955
		or 1S2471
D 404	Diode	RU2
		or 1S1834
		ER24-06
D 405	Diode	HZ24
		or MZ324
		or RD24E
		or EQA01-24
D 501	Diode	1S2076
		or 1S1588
		1S953
		1S2473
D 502	D-Zener	HZ7-B
		or MZ307-B
		RD6.8E-B3
		RD7.5E-B1
		EQA01-07S
D 504	Diode	1S2076
		or 1S1588
		1S953
		1S2473
D 505	Diode	1S2076
		or 1S553
		1S955
		1S2471
D 507	Diode	RU2
		or 1S1834
		REC24-04
D 508	Diode	RH1
		or S5295G
		ERB28-04

Part No.	Description	Specification
D 509	Diode	1S2076
		or 1S1588
		1S953
		1S2473
D 510	Diode	RH1
		or S5295G
		EBR28-04
D 511	Diode	1S2076
		or 1S1588
		1S953
		1S2473
D 512	Diode	HZ-7
		or MZ307
		RD6.8E
		EQA01-07S
D 901	D-Bridge	3D4B41
		or RB402
D 902	Diode	RU2
		or 1S1834
		ERC24-06
D 904	D-Zener	HZ7
		or MZ307
		RD6.8E
		EQA01-07S
D 905	D-Zener	HZ7-B
		or MZ307B
		RD6.8E-B3
		RD7.5E-B1
Q 901	Transistor	2SC2555
Q 902	Transistor	2SA1091
Q 903, 904	Transistor	2SC2383
		or 2SC2482
		2SC2610
IC 401	IC	HA11235
	V-Out Assy	
	H-Out Assy	
KC 590532	Heat Sink-A	
KL 590399	Heat Sink-V	
Q 301, 302	Transistor	2SC2611
Q 303		or 2SC2456
		2SC2688
		2SC1749
F-901	Fuse	125V, 3A
		5 x 20 MM
		CSA. UL.
F-902	Fuse	0.8A

Part No.	Description	Specification
R 301	R	1/4SB 220-J
R 302	R	1/4SB 220-J
R 303	R	1/4SB 220-J
R 304	R	1/4SB 1.2K-J
R 305	R	1/4SB 1.2K-J
R 306	R	1/4SB 1.2K-J
R 307	R	1/4SB 330-J
R 308	R	1/4SB 330-J
R 309	R	1/4SB 330-J
R 310	R-Metal	2W 8.2K-J
R 311	R-Metal	2W 8.2K-J
R 312	R-Metal	2W 8.2K-J
R 313	R-Solid	1/2W 2.2K-J
R 314	R-Solid	1/2W 2.2K-J
R 315	R-Solid	1/2W 2.2K-J
R 316	R-Solid	1/2W 1M-J
RV 301	R-Variable	RVA0911H 5KB
RV 302	R-Variable	RVA0911H 5KB
RV 303	R-Variable	RVA0911H 5KB
RV 304	R-Variable	RVA0911H 220B
RV 305	R-Variable	RVA0911H 220B
C 304	C-Ceramic	50V 271K
C 305	C-Ceramic	50V 271K
C 306	C-Ceramic	50V 271K
C 309	C-Ceramic	1KV 102K
Q 301, 302	Transistor	2SC2611
Q 303		or 2SC2456
		2SC2688
		2SC1749

11. CRT SCHEMATIC DIAGRAM

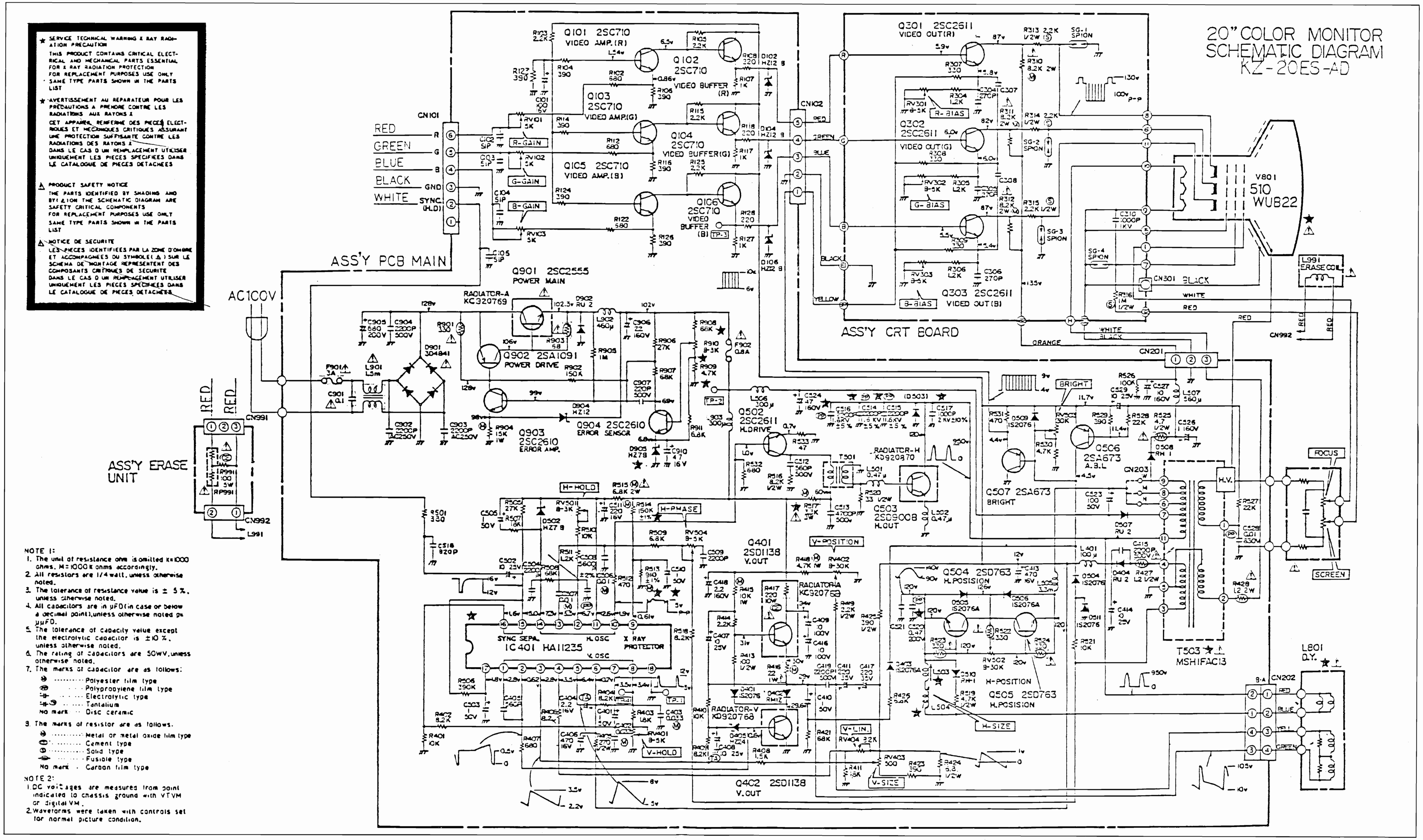


Fig. 16 CRT Scdematic Diagram

TEHKAN, INC.

Victoria Business Park
18010S. Adria Maru Lane
CA 90746 U.S.A.
Phone: (213) 329-5880

Printed in Japan